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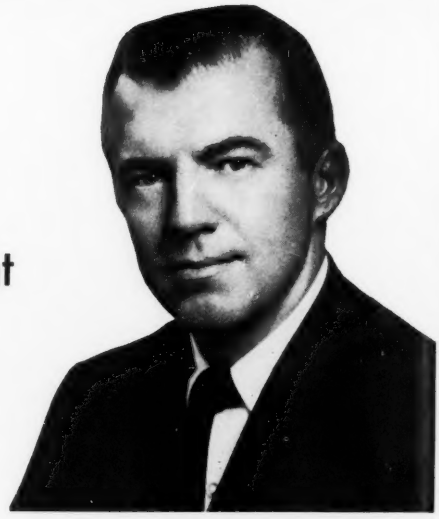
from your president



The activities of the State Units Committee under the leadership of President-Elect James Simmons, have been particularly vigorous and fruitful this year. At this time groups of A.S.D.C. members in the states of Kansas and Mississippi have completed the mechanics necessary to form Units in their states. They will be recognized formally at the Annual Meeting in Los Angeles. Several other states, including Delaware, Louisiana, South Carolina and South Dakota, are in the process of organization. The State Units Committee should be commended for its hard work and ingenuity.

Paul Weber and Joel Freedman, Executive Council members, attended the recent White House Conference on Children and Youth. They have reported fully on the activities and importance of the meeting. Some of the policies developed will have considerable impact on our Society.

Soon the membership will receive applications for hotel accommodations in Los Angeles. Since housing facilities are at a premium in this city, you are urged to return your requests promptly. This meeting promises to be one of the best in the history of A.S.D.C. Make your plans now to attend.

WILLIAM E. BROWN

How Good Is Vital Pulpotomy for Primary And Permanent Teeth?

MICHAEL G. BUONOCORE, D.M.D., M.S.*

THE quantity of literature relating to the treatment of the dental pulp and specifically that dealing with vital pulpotomy is indeed impressive. What is reported in this literature, however, leaves one quite unimpressed with the progress that has been made in the treatment of inflamed or diseased vital pulps, aimed at preserving their vitality. I think this feeling must be shared by many workers in this field. The literature that was written nearly a hundred years ago contains as worthy scientific considerations of the problems relating to maintaining the vitality of pulp tissue as any of our more recent literary endeavors. Although new drugs, improved diagnostic technics, and operative equipment have become available, treatment by vital pulpotomy is still largely empirical.

As far back as 1873, a Dr. Cutler,[1] in talking about the formation of calcific barriers stated, and I shall paraphrase, "One reason why calcific deposits do not oftener occur under a decaying surface when reaching the pulp is the result of an acid action due to caries. Where this decay penetrates deep into the tooth there has been a lessening of vital resistance of the pulp beneath the carious region, if not in the entire pulp. The tendency of the pulp to calcify is in proportion to the weakening of pulp vitality, when this calcification is not counteracted by the presence of acid. The calcification process moreover is under vital control to an extent, as we see that this process ceases at the death of the pulp." In view of the above, Dr. Cutler's plan was to use some alkali in the decayed tooth for a day or two to neutralize acids and then to treat with phenol followed by a restoration. From among these very astute observations I would like you to note particularly the reference to the use of an alkali. Thus, even the use of calcium hydroxide, our so called miracle alkaline ingredient, does not seem to be entirely predicated on any new principle. We now know a lot more of the chemistry of inflammation and recognize that it causes or may be associated with an acid condition. Although the use of calcium hydroxide may in part be directed toward the neutralization of this acidity and thus favor healing, this principle is not different than that outlined years ago. That the hydroxide ion (pH) of calcium hydroxide, rather than the calcium, may be the more important factor in pulpal healing has been suggested by the work of a number of researchers.[2, 3, 4]

Recently some rather interesting experiments have been done by James Avery and Milton Panzer[5] using radioactive calcium hydroxide applied to the amputated pulps of dogs' teeth. These workers reported that the radioactive calcium 45 was found along the connective tissue barrier which isolated the area of pulpotomy from the remaining healthy pulp. Moreover, they found little or no calcium 45 directly in the healthy pulp nor in the odontoblasts. This definite, limited penetration of the calcium ion suggests quite strongly that

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the pulp does not need this element for the elaboration of the calcific bridge. Similar conclusions have been reported by other workers using different technics.[6, 7] By analogy, therefore, other elements chemically related to calcium such as magnesium, strontium and barium would also be expected to be limited in penetration. Thus the calcific bridging reported when magnesium hydroxide was used for pulp capping may well be the result of the alkalinity due to the hydroxide ion rather than to the magnesium ion.[4] On the other hand, it is becoming increasingly evident that calcific bridging may require neither calcium nor hydroxide ion.[3, 4, 7, 8, 9, 10] If we add to this the fact that serious question is being raised regarding the formation of a dentin bridge as a good criterion for healing, the situation becomes more confusing.[10, 11]

Dr. Berman[12] in his recent critical review of the literature relating to pulpotomy stated that a Dr. Hunter in 1883[13] used sorghum molasses and the droppings of the English Sparrow for pulp treatment and claimed 98 per cent success. Ridiculous as this medicament may seem, perhaps we should withhold criticism until a chemical analysis and a pH determination is made on this mixture!

While we must be appreciative of the apparent benefits of calcium hydroxide in stimulating calcification, an awareness of its limitations is equally desirable. I have always felt that one of the shortcomings of calcium hydroxide was in the fact that this agent is not known to have bactericidal or bacteriostatic activity in advance of the area of its placement. If data are available on this subject they have not come to my attention. The traumatic nature of the pulpotomy operation coupled with the fact that in all likelihood bacterial contamination in varying degrees is present in the vital pulp, beyond the site of amputation, certainly establishes the need at least for a mild antiseptic action. The large number of failures associated with the treatment of primary teeth using calcium hydroxide may in part be attributed to this lack of an antibacterial effect of the capping material. Another deficiency of calcium hydroxide appears to be in the relatively large amount of tissue destruction which results from its application. When one is attempting to save the rather small remnants of radicular pulp tissue this destruction becomes quite important. Moreover, diffusion of entrapped bacterial and tissue toxins from this area of breakdown to the remaining vital pulp, when superimposed on its existing injury, can only contribute to further tissue loss and/or the establishment of a chronic inflammatory condition. The high incidence of internal resorption observed by many research workers in treated primary teeth may well be related to the existence of such a condition. Histological evidence along these lines has been nicely demonstrated by Via[14] in his report evaluating primary pulpotomies. Now the question of whether evidence of internal resorption should be reason to consider a treatment a failure is an interesting one. Consideration in these instances should be given to the rate and extent of this resorption as many cases may show repair after a time.

In the treatment of pulp disease there is always much profound talk about observing biological principles. We are told that the acutely inflamed or infected pulp must never be additionally trauma-

† Presented at the Annual Meeting, American Society of Dentistry for Children, in New York City, September 1959.

tized before it is sedated and then only minimally; that cases with a history of prolonged or spontaneous pain are poor risks; that perfect sealing of the cavity is a prime requisite for success; that harsh medicaments are contraindicated; that one must use an aseptic technic in order to achieve a higher degree of success; that pressure must not be used when applying medicaments. We could go on this way and cover many other requirements. With regard to these points there is absolutely nothing in our present literature that was not said many decades ago and in what is to me a much more interesting literary style. In fact it seems we have stipulated a host of treatment conditions, some of which have a rather weak scientific basis.

In some of our modern technics, zinc oxide and eugenol is presently recommended for sterilizing carious dentin, and for sedating and disinfecting the pulp after removal of necrotic tissue from an obvious carious exposure prior to pulpotomy. On general principles this is a rational approach, accepted and used by many practitioners with apparent success. However, in looking for the scientific grounds on which this use of zinc oxide and eugenol is predicated I was not able to find any *in vivo* evidence that this material effectively sterilizes carious dentin or that it can destroy infection in the dental pulp. In the absence of direct experimental *in vivo* evidence of the antibacterial potency of zinc oxide and eugenol it must be concluded that its use in this sense is purely empirical. It is more probable that the main effect of zinc oxide and eugenol is to sedate the pulp so that pain symptoms are masked while the infection continues somewhat abated as the result of the removal of the immediate exciting causes. The prognosis of this infection then becomes dependent on the original condition of the pulp and the systemic background of the patient.

In some interesting pulpotomy experiments on teeth that most investigators probably would not recommend for pulpotomy but which perhaps they should attempt to treat—that is teeth with extensive caries and history of pain—Drs. Englander, Massler, Carter and James[15, 16] attempted to assess the response of these presumably infected pulps to a variety of agents. These authors reported in one article that the use of defatted bone powder and dentin powder gave 100 per cent clinical success as indicated by absence of pain. This was a six week average observation time. Similar results were obtained using zinc oxide and eugenol. Later, however, I found another reference in abstract form relating to the histology of the pulps of these same teeth.[16] In this report all the teeth treated with dentin and bone powder and which previously showed 100 per cent clinical success based on absence of pain symptoms, now revealed histological evidence of varying degrees of inflammation with 55 per cent of them demonstrating internal resorption. I have so far not been able to find the histological report on the zinc oxide eugenol treated teeth. Such data should have direct bearing on the effect of zinc oxide eugenol on infection in the pulp particularly since control teeth were also available for comparison in these studies.

These reports are characteristic of the wide discrepancy between clinical and histological evaluation particularly with reference to pain. Since in all teeth in this experiment zinc oxide eugenol was used over the treatment agent, the absence of pain might be attributed to its sedating effect.

In another report dealing with the same subject material of the previous study, a histological assessment of the effect of calcium compounds and antibiotics on healing was presented.[17] In this article only the histological outcome is reported, yet in the previous paper[16] it was stated that complete post-operative histories and x-rays had been taken of all cases although these data are not presented. It would indeed be regrettable if this information should not be made available so that much needed comparisons between clinical and histological findings may be made. I sincerely hope that these results will soon be published as there are too few studies of the type involving the treatment of infected pulps with a history of pain.

It seems fairly evident that in nearly all cases requiring as drastic a treatment as pulpotomy, the presence of bacterial contamination is probably the rule. Compared to years ago we have available today a wide variety of antibiotics for combatting infection. Regarding their use for pulpotomy the results so far obtained do not indicate that they are satisfactory. On the other hand the possibility exists that these drugs are not being properly used. According to Dr. Sidney Rubbo[18] of Australia "All polyantibiotic mixtures recommended for dental use show a complete disregard for interantibiotic antagonisms." In view of the multiplicity of bacterial types which may infect the pulp one antibiotic used alone may fail. It may also fail because it is inactivated by the other medicaments used with it, for instance penicillin used with $Ca(OH)_2$. Dr. Rubbo has suggested a combination of drugs which may be helpful in destroying infective agents. To my knowledge it has not yet been used in conjunction with treatment by pulpotomy. The formula for this combination is neomycin, bacitracin, sodium caprylate and zinc oxide as an excipient. This mixture can probably be handled in solution or paste form for painting over the infected area. The formula has some very desirable characteristics such as: the antibiotics used are well tolerated by sensitive tissues and hence are not chemical irritants; these antibiotics are effective against a wide spectrum of organisms; the sodium caprylate is toxic to yeast and fungi; the combination is stable and the antibiotic action is synergistic. Moreover, these antibiotics are not likely to be used for systemic therapy, so should the development of resistance strains occur, it would be unimportant.

The evaluation of success or failure of a treatment depends on the criteria that are used. In this respect there will probably always be a discrepancy between clinical and histological assessments. It is certain that a clinical failure will be histologically verified but not so the reverse situation. Aseptic pulp degeneration, necrosis, chronic inflammation may go on for years undetected. From the aspect of every day dental practice, many potential histological failures are functional successes. The uncertainties associated with our present clinical diagnostic procedures renders decisions with respect to such cases unreliable.

It is a discouraging situation when the results of carefully evaluated data indicate a success of about 35 per cent for primary pulpotomies.[14, 19] On the other hand before condemning this procedure as not sufficiently effective, consideration should be given to the success prognosis of substitute treatments. Saving one tooth out of three is certainly better than none at all. The difficulties associated with treatment technics for pulp disease

are tremendous if for no other reason than two complex variables, the dentist and his patient.

With young permanent teeth the situation appears less discouraging. Here the percentage of success is considerably higher than with primary teeth. Unfortunately, however, there have been insufficient studies over the long term to accurately evaluate the degree of success. This is an important consideration for permanent teeth whose life span is anticipated to be considerably longer than the primary teeth. Credit for success in such treatments cannot be ascribed exclusively to one agent or technic. Calcium hydroxide, zinc oxide eugenol and other ingredients have all demonstrated the capacity for success at least over the short term. Until such time as we have accumulated long term data on the effectiveness of pulpotomy I would prefer to consider the treatment as purely temporary. The usefulness of pulpotomy to allow for the completion of root formation, to maintain the vitality of multirooted teeth where other technics are extremely difficult and the prognosis poor, is unquestionably important. However, as indicated by the experience of many, the short term success picture after pulpotomy is followed a few years later by severe retrogressive pulp changes.[20] While such changes normally occur as part of the aging process the resulting pulp tissue presents a considerably lowered vitality during a period when maximum vitality may be demanded.

What I have mentioned here are but a few thoughts on this intriguing subject. There are many problems associated with vital pulpotomy that require considerable and painstaking research and particularly in the field of diagnostic criteria. Some of my own efforts have been directed toward developing materials that will form strong bonds to tooth structure with the idea they may be useful in the effective sealing of medicaments in pulp therapy or as capping agents. Those of us who are doing research know that the road is rough and we encounter many disappointments. Occasionally we do get a promising lead. For pulp therapy calcium hydroxide was an outstanding discovery, although enthusiasm for this material may wane. In my opinion there has perhaps been so much of an obsession for calcium hydroxide that other equally rational approaches are perhaps being overlooked or not adequately tested. In any event let us be encouraged by our successes and try to learn from our failures. I believe we have not achieved the best we can with vital pulpotomy. I am sure that the many questions still to be answered regarding vital pulpotomy will ultimately be resolved through additional well integrated research.

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The Number and Types of Films Necessary for A Satisfactory Radiological Survey for Children*

WILF H. FEASBY, D.D.S.

I. THE REQUIREMENTS OF A RADIOLOGICAL SURVEY FOR CHILDREN

A REVIEW of the requirements of a survey in terms of the conditions frequently revealed will serve as a guide in selecting suitable technics.

Lozier[18] and Morgan[22] have stated that nearly every type of dental pathology found in adults may be found in children. Sweet[28] stated that at least 20 per cent of all the children examined had dental abnormalities or pathologic conditions that could be positively identified only by means of the radiograph. Morgan[22] has stated that the bite-wing examination is not practical because "we are interested in more than the proximal surfaces." This suggests that dental pathology be as earnestly sought in children as in adults.

Various authors have outlined the conditions and areas that a radiological survey for children should reveal.

a. *Incipient caries.* It has been reported[3, 5] that 40 to 50 per cent of the detectable carious lesions would be overlooked if a radiographic examination were not used. Finn[12] emphasized the value of early detection of caries in children because to wait until the proximal caries are detectable clinically may frequently jeopardize the integrity of the tooth.

b. *Pulp morphology and related hard tissues.* A knowledge of the outline of the pulp is of importance in determining operative procedures and in revealing abnormalities such as dens in dente.[16] Several authors[4, 7, 18, 22] have stated that the radiographic survey should show the outline of the pulp and its relationship to the hard tissues.

c. *Environment of the root ends of the primary teeth.* Brown[7] and Lozier[18] have pointed out that a survey should make it possible to estimate the calcification or resorption of the root ends of the primary teeth. Dental pathology can be detected in the periapical area according to several authors.[4, 8, 11, 18, 22, 25, 32]

d. *Extent and quality of the calcification of the crowns of the permanent teeth.* It has been pointed out that the calcification of the crowns of the permanent teeth should be clearly shown.[2, 12, 19, 22, 27] The relationship of the crowns of the unerupted teeth to the roots of the primary teeth has been shown significant in supervising occlusion[4, 17] and as a guide in surgery.[18]

e. *Dental anomalies.* Anomalies that may occur have been classified for the purpose of radiographic study.[7]

(1) Anomalies of number. Included under this heading are supernumerary and missing teeth[7, 18, 22, 27, 28, 32] and ectodermal dysplasia.[12]

(2) Anomalies of shape. This group includes peg teeth, Hutchinson's incisors, mulberry molars, dens in dente[14] and macrodontia.[12]

(3) Anomalies of position. Included in this group reports have mentioned a great variety of abnormal positions and

* Presented before the American Academy of Pedodontics, August 1958.

ectopic eruption,[14] impactions and ankylosis.[12]

(4) Anomalies of texture. This group includes hypoplasia,[7, 22] hereditary opalescent dentin,[16] accompanied by obliteration of the pulp chambers and root canals.[7, 16]

f. *Alterations in the integrity of the periodontal membrane.* Specific reference was made to this condition in diagnosing apical pathosis.[12]

g. *Alterations in the supporting hard structures of the teeth.* This group includes abscesses, cysts, tumors, periodontal disease, and some systemic diseases.[12]

h. *Injuries to the teeth and supporting structures.* Included here is radiographic evidence of trauma, dilacteration, and location of foreign bodies.[6, 12, 14]

The significance of the conditions that a survey should be able to reveal will not be discussed. However, it was established that a complete radiographic survey must record accurately all dental and associated structures.

II. Radiation Hazards

In our enthusiasm for a radiographic examination we must not lose sight of the hazards involved in radiation. In both professional and lay literature there has been considerable attention drawn recently to the hazards of all ionizing radiation. The introductory paragraph of a statement prepared by the Research Committee of the Canadian Dental Association is pertinent here.

"The value of the x-ray as a diagnostic aid in dental practice cannot be questioned. However, because of the increasing use of the x-ray and because of the increased exposure of the public to radiation from other sources, the dental profession owes it to the public and to itself to review its practices in connection with the employment of the x-ray and to make an effort to reduce the hazards in this connection where feasible."[9]

On this subject the American Academy of Oral Roentgenology has prepared a statement from which the following was selected: "If the dental profession does not take steps to use x-ray radiation more efficiently and judiciously, regulations regarding the use of the dental x-ray machines probably will be forthcoming in the future."[23]

Various methods of reducing radiation exposures are repeated here:

a. The use of high speed film.[9, 10, 12, 14, 21, 23]

b. Increasing KVP (voltage).[9, 10, 12, 14, 21, 23]

c. Improving development technic.[14, 23]

d. Aluminum filtration.[9, 23]

e. Lead diaphragm.[9]

The method of reducing radiation exposure most pertinent here is the use of high speed films. It has been estimated that the use of high speed films will reduce the patient's radiation dosage by from 66 per cent[9] to 80 per cent.[23] Thus, for other than radiographic reasons, a technic should be employed which makes use of the fastest film now procurable.

In addition, clinical problems such as gagging and restlessness make fast films advantageous, especially for the younger age group.[10, 12, 14, 15, 24, 30]

III. A Review and Appraisal of the Suggested Technics for Children

a. *Age Classification.* A review of the literature to discover the age at which radiographic surveys should be initiated was completed. There was general agreement that a survey should be routine in examination procedures from age 3. While all age differentiation of technics was found to be arbitrary it was based

on the clinical limitations of the patients.[12] For the purpose of this review the age grouping will be 1. preschool or primary dentition and 2. mixed dentition.

b. *Technics for the preschool age group.* Thompson's[30] survey consisted of ten child size films and two bite-wing films. Allen,[1] Bierman,[4] Budowsky,[8] Finn,[12] and Rockman[24] proposed similar surveys. These consisted of three or four films of the anterior region plus periapical views of each molar region and bitewings. The periapical views are exposed with the film resting against the lingual of the teeth and require that the patient or parent hold the film while the patient's mouth is open.

Hayden and Richards[14] proposed a survey of six adult size films. They used one film in the occlusal plane for each of the maxillary and mandibular anteriors, and a posterior maxillary film in the occlusal plane. The film was held by the teeth in occlusion and the central ray was directed at 60 degrees from the occlusal plane. Two posterior bitewing films were included but it was suggested that child size film could be substituted here.

Two lateral jaw extraoral films completed the survey.

McBride[20] suggested four posterior periapical child size films, two posterior bite-wing films of the same size and one adult size anterior occlusal plane film each for the maxillary and mandibular incisors for a total of eight films. The posterior periapical films were held by a plastic holder (Rinn Snap-a-ray) so that all exposures were made while the patient's mouth was closed.

A technic using four adult size films has been recommended by Brown[7] and Waggener.[33] The set consisted of two posterior bite-wings and two anterior occlusal plane films. The ease of this technic and its economy was stressed.[6] Child size bite-wing films were accepted as substitutes but the superiority of adult films was pointed out.

Updegrave[32] used anterior occlusal plane films, two posterior bite-wings and four posterior periapical views. He suggested small films or trimmed packets could be used if necessary. Lozier[18] recommended child size films because of the tender oral tissues, and the use of no-screen extraoral films when the intraoral approach was not possible.

Simpson[25] stated that fourteen films were a minimum number of films for a satisfactory survey. The curve of the anteriors made one film in the occlusal plane inadequate in his opinion. He stated that extraoral films were useful accessories but that they did not give sufficient information. Main[19] recommended a twelve film survey using adult size films. However, he conceded that extraoral films and occlusal projections were sometimes useful. Ennis[11] recommended extraoral films and anterior occlusal films with intraoral films used at subsequent examinations. Sweet's[28] survey consisted of eight adult size films.

Kelsten[15] suggested adult films in ten regions; one incisor, two cuspids and two posteriors in each arch. Where the child proved difficult he reduced to a six film survey of four posterior films and two anteriors. He stated that the extraoral films do not give sufficient detail. Koch[16] recommended the general use of adult size film for preschool children. He used views of the incisors and posterior interproximal views. McCall and Wald[21] proposed sixteen films in a survey using child size films. Morgan[22] stated that a bite-wing examination alone

was insufficient and he recommended extraoral film at age three and one half years. Cohen[10] used child size film for younger children but took eighteen exposures.

This review of technics for preschool children displays a variety of approaches. The various points of difference are paired for critical appraisal.

(1) Adult size vs. child size film. Considering the problem of the posterior periapical views some authors[1, 18, 30, 33] preferred child size films because they are more comfortable and required a minimum of bending. Others[14, 16, 24] stated that the greater coverage of the adult size films outweighed any facility offered by the smaller packets. However, it was admitted that the adult size films must be bent for posterior views on preschool children.[14, 15] These opposing positions are reconciled by Finn's stand. He stated that the adult size films were preferable but that the smaller size films were acceptable for a survey for preschool children.[12]

(2) Extraoral films vs. intraoral films. This divergence of opinion refers to posterior periapical studies. Extraoral film was recommended by Ennis,[11] Hayden,[14] and Morgan[22] as a routine procedure. Budowsky,[8] Koch,[16] Lozier,[18] Main,[19] Sweet[28] and Updegrave[32] suggested extraoral films as a substitute for intraoral films when the latter were not tolerated or as supplementary films to give greater coverage. A third view was held that the extraoral film did not give sufficient detail and was a compromise that was unacceptable.

Since extraoral films for the posterior periapical views do not have wide support in the literature and are attacked by some as inadequate, their routine use in surveys is rejected.

(3) Open mouth film retention vs. closed mouth retention. This controversy refers to periapical views, both anterior and posterior. The open mouth technic requires that the film packet rest against the lingual of the teeth and be held by the patient's or parent's finger. This is integral to the multiple film survey of anterior teeth.[1, 12, 24, 30] The closed mouth technic is more comfortable and reliable which makes it suitable for preschool children.[7, 14, 20, 23] A plastic holder has been suggested so that posterior periapical films could be exposed with the mouth closed.[20] Various other holders have been suggested for the positioning of these films.[12, 33] Hayden[14] suggested using an occlusal plane view of the maxillary posterior teeth. However, this view does not separate the primary molars from the developing bicuspids because of the high angulation of the central ray.

If a closed mouth technic is used for anterior exposures, one adult size film was recommended. Thus, two new points of difference arise; i.e. single occlusal views of anterior teeth vs. multiple periapical views. Simpson[25] stated that anterior occlusal views could not serve as a substitute for separate views of the arc formed by the cuspids and incisors. Other authors[1, 4, 8, 15, 16, 24, 30] all suggested multiple film exposures of anterior teeth. However, Brown,[7] Hayden,[14] McBride,[20] Sweet,[28] and Waggener[33] recommended single occlusal anterior film, while Ennis[11] and Main[19] preferred it for the youngest patients only. It was also suggested that further periapical views were sometimes necessary and that the right angle long cone technic was preferred here.[33] It is interesting to note that the latter group has supported a technic that was claimed to radiograph the area satisfactorily. This is in contradiction to the stand of Simpson.[25] In defence of the single anterior occlusal plane exposure,

it has been stated that it is not unduly burdensome since the ability of patients in this group to cooperate is limited.[33]

The open mouth vs. closed mouth technic controversy must be resolved on two points: radiographic adequacy and the ability of the patient to cooperate. The stand of Simpson et al. for the open mouth technic is a sound one theoretically but the opposing view is supported because it is clinically practical for the age group under study. The radiographic result was held to be adequate but it was conceded that further films were sometimes needed.

The open mouth multiple anterior film technics are capable of enthusiastic expansion from twelve to eighteen films.[10] The closed mouth technic requires fewer films and is in closer agreement with the recommendations of the section on radiation hazards which stressed the necessity of reducing radiation exposure.

After a critical appraisal of the technics proposed for a radiographic survey for preschool children, the following points have been ascertained: (1) While adult size films are preferable, child size films are more practical clinically. (2) Posterior periapical films are preferred to extraoral films for routine survey purposes. The extraoral films were recommended as a substitute or supplement when intraoral films were not tolerated or when wider areas were to be studied. (3) The closed mouth technic offers clinical advantages for preschool children. Holding devices allow the method to be used for posterior periapical films while in the anterior region a single film in the occlusal plane records the area adequately and reduces the amount of radiation used.

It follows, therefore, that the technic of choice is that described by McBride[20] and cited earlier. It consisted of four posterior periapical films and two posterior bite-wing films all of child size, and two anterior films, adult size in the occlusal plane, for a total of eight films. Since the choice of technic was frequently determined by the limitations imposed by the patient, and since the evidence was drawn from published opinions only, the proposed technic cannot be defended as the only good technic for preschool children.

c. *Technics for the mixed dentition group.* The divergence of opinion concerning the size of films, film retention method and the number of anterior exposures was less critical in the mixed dentition. Waggener and Ireland[33] stated that more cooperation could be expected of the children in this group. Therefore, the fingers as well as cotton rolls could be used to position and retain the film.

The fourteen adult film survey is the most frequently mentioned survey for the mixed dentition. The survey consisted of one film for the central and lateral incisor area, one film for the cuspid area, one film for the primary and permanent molar areas in each quadrant plus two posterior bite-wing films. Modifications of film size for the anterior teeth and the posterior bite-wing exposures have been proposed. The surveys involving closed mouth technics and fewer films were less popular at this age. The age of the child made this compromise unnecessary. Sixteen and eighteen film surveys have been suggested but evidence was not presented to justify the additional radiation exposure.

IV. Conclusions

1. A full survey technic was recommended from age three years to record all dental and associated structures.

2. For preschool children, an eight

film survey was recommended. It consisted of four posterior periapical films, using holders, and two posterior bite-wing films—all of child size, and two adult size films for the anterior region held in the occlusal plane. All films were exposed with the patient's mouth closed.

3. For the mixed dentition, a fourteen film survey was recommended. This was comprised of four posterior periapical films, two posterior bite-wing films of adult size and eight anterior adult or adult anterior size films.

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Application of Roentgenographic Cephalometry To Pedodontic Research*

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I. INTRODUCTION

IN 1958 one of us (S.P.) was invited to serve as a consultant to Study Group VI, "Relationship of Orthodontics to Other Health Services" at the Workshop in Orthodontics held at the University of Michigan.[1] Just prior to that meeting, a committee report entitled, "How Much Orthodontics Shall the Pedodontist Do?" was published in the JOURNAL OF DENTISTRY FOR CHILDREN.[2] As might have been expected, this report was the topic for much conversation. Since the chairman of the committee which published this report was a member of Group VI in the Orthodontic Workshop, the matter of orthodontic-pedodontic relations was reviewed at some length.

At one point, the orthodontic consultant suggested to his pedodontic colleagues that since they practiced some form of orthodontic therapy, they should at least employ the diagnostic and record-keeping procedures of the orthodontist, and in a friendly way, the pedodontists were prodded to do more research in growth and development. Indeed, the failure to take advantage of roentgenographic cephalometry as an instrument for pedodontic research was difficult to explain.

As an illstration of how collaborative efforts between the orthodontist and pedodontist might prove to be fruitful, the consultant cited his experience at the University of Illinois where cephalometric research was already producing data supportive to the teaching and practice of pedodontics, and as a result of the discussion, the orthodontist was invited to speak on cephalometric research at the Kenneth A. Easlick Graduate Society meeting in Ann Arbor the following year. The feedback of interest and stimulus from this Society confirmed our feelings regarding the need for the formulation of a research proposal in roentgenographic cephalometry that would reflect the special interest and needs of the pedodontist.

The contribution of cephalometric roentgenography as a research tool for the investigation of facial growth and development as well as tooth eruption patterns is well established. Primarily this tool has been widely employed in problems concerning the orthodontist, the speech pathologist, anthropologist, and more recently, the prosthodontist. The application of cephalometrics in the area of pedodontic research and practice has been neglected even though the pedodontist has considerable concern with the developing dentition of the child. Considering the potential value of such informa-

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tion and its application to pedodontic practice, the ultimate gain to the practitioner concerned with the developing dentition of the child well warrants such research.

What follows is a preliminary report of our efforts in this direction.

II. Armamentarium and Method

A longitudinal study which involves roentgenographic cephalometry requires accurate equipment for obtaining oriented headplates. The quality of the technique and the films obtained should equal the standards that have been determined through years of cephalometric research. In addition, it would be desirable to utilize equipment that could be duplicated in the average dental installation.

The equipment consists of an x-ray source that can be held in a fixed position and headholder, or positioner (Fig. 1). The Wehmer headholder satisfies the accepted standards for roentgenographic cephalometry and, as a unit, may easily be rotated for standard frontal and lateral films as well as any desirable hori-

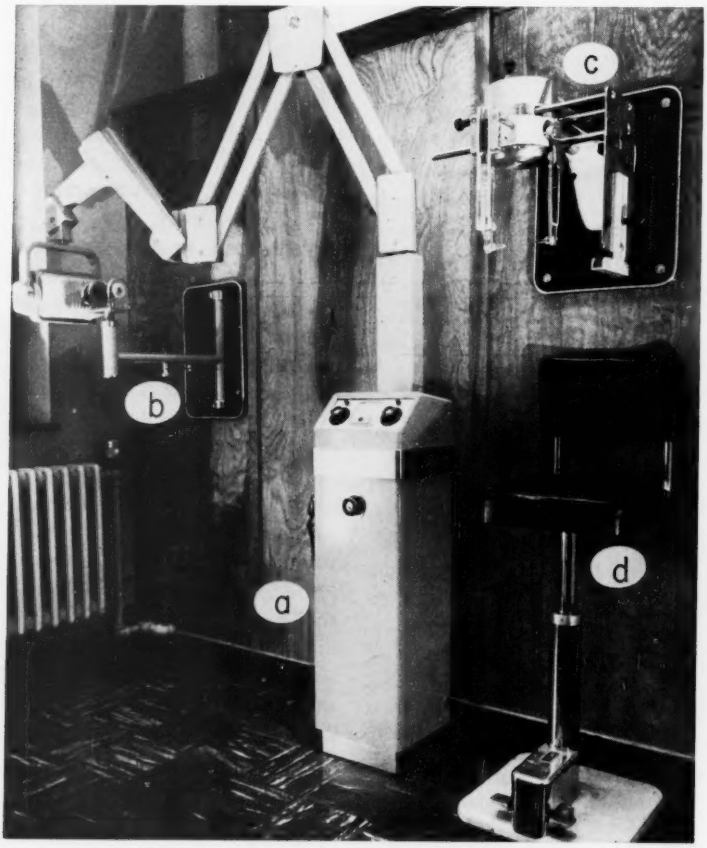

Figure 1. Cephalometric installation suitable for office use: (a) high voltage dental x-ray machine, (b) removable fixator for the x-ray head, (c) head-holding device with cassette carrier, and (d) electrically driven chair.

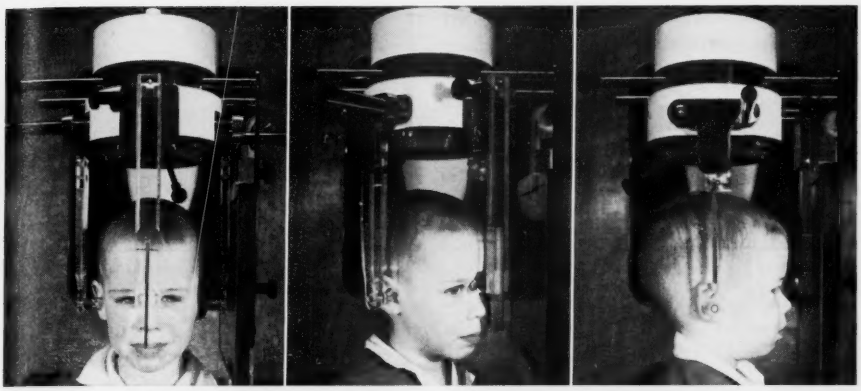

FIGURE 2. Various positions for the lateral, frontal and oblique x-ray projections. Left: positioned for the lateral projection. Center: positioned for the left oblique view. Right: positioned for the frontal view.

zontal angle in relation to the cassette. During the development of this headholder in the laboratory of the Cleft Palate Center, it was decided to incorporate settings for the "oblique" film. Consequently, stops were machined in the headholder for a 45° lateral oblique view of the mandible, maxillae, and the condyles. In every case the standard five foot target distance is maintained.

The x-ray source and headholder are adjusted so that the central beam projects through the earposts of the headholder superimposing one upon the other and at right angles to the film plane. The focal point of the x-ray source and the midsagittal plane of the headholder are at the standard of five feet target distance.

Figure 1 shows such an installation using a General Electric Model No. 90-11 x-ray machine (a) and a Wehmer headholder (c). The x-ray tube head is fixed in position by a locking collar (b) attached to a wall-mounted arm. The length of the arm is such that the focal point of the x-ray source and the earposts of the headholder are the same distance from the wall. The tube head is readily removed from the collar, and the fixator arm can be swung out of the way to rest against the wall, allowing the use of the x-ray machine for other purposes than from cephalometrics.

In addition, a chair is required which can be easily adjusted in height to accommodate the various patient statures. The chair illustrated (Fig. 1d) is motor driven in both vertical directions allowing small adjustments in height with a minimum of difficulty. The chair also freely rotates on its base allowing rapid change in the patient's position from frontal to lateral and vice versa.

The cassettes used are standard 8 x 10″ metallic film holders with a bakelite face and contain dual intensifying screens. Positioned in one corner of each screen is a lead 1 x 3 x 1/32″ insert which prevents exposure of the film in this area and allows a later exposure with an identification plate.

VARIOUS PROJECTIONS AND THEIR USEFULNESS

Three projections of the head onto the film are employed in cephalometric investigation (Fig. 2). Of these, the lateral and frontal (postero-anterior) views are the most common. More recently, the

oriented right and left oblique views have been introduced.

Each of these views is generally obtained in centric relation or in other postures to meet special needs.

The Lateral View

Patient Positioning: When the patient is seated in an upright position so that his right side faces the x-ray tube, the chair is elevated slowly until the external acoustic meati (auditory canals) are at the height of the headholder earposts. The operator places a steadying hand on the patient's head while the earposts are drawn snugly into the ear canals (Fig. 2). In this position the earposts prevent horizontal rotation of the head. The head is then gently rotated in vertical direction until the inferior margin of the left orbit is horizontal to the earposts. The Wehmer headholder has a guage attached for this setting. The head is held in this position by the application of a blunt "rest" against nasion (Fig. 2). This "rest" extends down from the base of the headholder and can be adjusted both antero-posteriorly and vertically to fit snugly into the notch formed by the junction of the frontal and nasal bones (nasion).

When the patient is stabilized in this fashion his head is in the Frankfort horizontal position. The film cassette can then be inserted in the cassette holder and this, in turn, is brought in contact with the earpost and the exposure made.

Postures Employed: The usual sequence is to obtain the rest position film first (Fig. 3). This is best achieved by making the patient comfortable and allaying all apprehensions regarding the procedures employed. The chances of obtaining a "rest position" without special instruction seem to be at least as good, and certainly less energy consuming than when the patient is subjected to elaborate rehearsals. Next in the series is the view in centric relation. Other optional postures include wide open, sustained phonation of vowels for visualization of palato-pharyngeal valving, protrusion, etc.

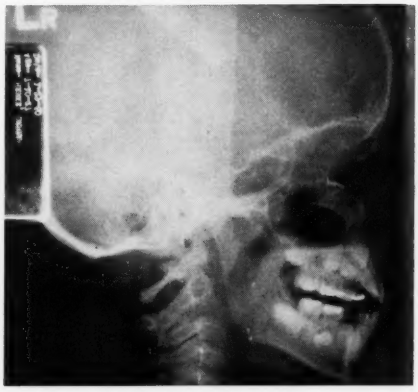

Figure 3. Lateral cephalometric x-ray film of a 7½ year old girl taken in the rest position.

The Frontal or Postero-Anterior View

Patient Positioning: The procedure for making an antero-posterior projection is the same as with the lateral film with the exception of the position of the patient and the film. The patient and headholder are rotated independently, so that the posterior aspect of the head faces the x-ray source. The cassette holder is then adjusted to be at the patient's face. The head is repositioned as before in the headholder, cassette placed, and the cassette holder is brought into contact with the nasal "rest" (Fig. 2), and the exposure is made.

Postures Employed: In the majority of cases, a single film in centric relation suffices. However, where it is of interest to document deviations in mandibular posture from rest to occlusion or from

wide open to occlusion, an added exposure recording the opening movements of the mandible is advisable.

The Oblique View

Since this view is relatively new to the field of roentgenographic cephalometry a brief statement relative to its origin is indicated.

Cartwright and Harvold,[3] in a paper devoted to the use of high kilovoltage in cephalometry, described the 45° oblique projection utilizing a modified Thurow headholder. In the legend describing the illustration of oblique projection, they wrote as follows: "The angle between the midsagittal plane and the film is 45°. The films, one of each side, show the dental arch relationship, the position and eruption direction of the teeth in the lateral parts of the jaw. The temporomandibular joint is usually clearly visible." Figure 4 illustrates a typical set of oblique projections.

Patient Positioning: The oblique cephalometric film is obtained by rotating the headholder independent of the film cassette so that the mid-sagittal plane of the head is at a 45° angle to the cassette (Fig. 2). This arrangement is possible only if the ear rod arms are mounted on a rotating base independent of the cassette holder. Thus, the cassette remains in constant perpendicular relation to the x-ray source for the frontal, lateral, and right and left oblique projections. In all cases the head is maintained in the Frankfort horizontal position.

Exposure Factors

Exposure factors for cephalometrics have been discussed by Cartwright and Harvold.[3] Their data may serve as a frame of reference for establishment of exposures in keeping with the x-ray equipment available in the individual office installation. However, the exposure factors with the equipment cited in the present paper are:

Frontal and oblique 1 second; Lateral at .6 second. In each case the machine was operating at 90 Kv. and 15 Ma. These are general exposure values for the mixed dentition age group. However, some downward variation in exposure should be allowed for smaller heads or younger age groups. Careful processing

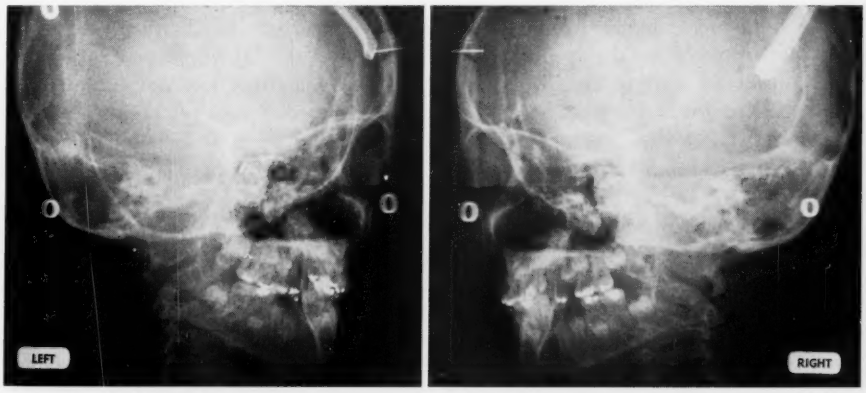

Figure 4. Right and left lateral oblique views (45°) of a 7½ year old female. Note the delineation of the maxillary and mandibular segments to allow study of each side of the arches individually.

of the films is an important link in the chain of events necessary to produce quality radiographic images.

III. Studies in Progress

In developing a program of research, our task was twofold. First, to determine the reliability of the specific method employed. Second, to determine which problems were susceptible to investigation by cephalometric research. One aspect of this investigation is already nearing completion at the present writing. Dried skull material was employed as a means for determining the accuracy of the lateral oblique film. This was done to establish the enlargement and distortion factors inherent in the oblique projection. Preliminary data indicate that measurements from the lateral oblique film are valid, thus substantiating the viewpoint of Hatton and Grainger.[4] The lateral oblique projection is indicated wherever it is desirable to visualize either side of the dental arch without the overlapping and obscuring shadows of the opposite side. An additional facet of this study is to find a method whereby lateral oblique films may be oriented and superimposed for serial study.

The following clinical problems, of particular interest to the pedodontist, were considered and specific questions were stated to guide our studies:

Cross-bites:

1. What postural deviations are encountered in jaw position for anterior and posterior cross-bites as the mandible moves from rest to occlusion?
2. Is the asymmetry limited to the dental arch or does it include structures beyond the alveolar process?
3. By what mechanism does a bite plane correct the cross-bite? Is it by a change in the axial inclination of the teeth, by an opening of the bite, or by a repositioning of the mandible?
4. What are the effects of such correction on the unerupted succedaneous teeth?

Thumbsucking:

1. When a deformity in the dental arch is found to be associated with thumbsucking, it becomes interesting to determine whether the deformity persists following cessation of the habit or whether it increases in severity as the habit persists.
2. If the deformity resolves itself following cessation of the habit is there a critical age or state of development at which such cessation must occur?
3. Is there a point of no return in arch development beyond which there will be no spontaneous resolution even if the habit ceases?
4. Does thumbsucking alter condyle-fossa relationship?
5. Does it warp jaw growth?

Obviously, the one way to answer these questions is through cephalometric documentation.

Pulp Therapy: The therapy of infected teeth utilizing pulpotomy and pulpectomy procedures in dentistry for children raises several questions:

1. What effect does pulpotomy have on the rate of root resorption?
2. What effect is seen on the eruption of the permanent successor?
3. Is there a measurable comparative difference between the several techniques commonly employed?

Space Maintenance: Space maintainers are probably the most commonly employed preventive appliances used in dentistry for children and yet how much factual knowledge is at our disposal in terms of an evaluation and measurement

of the effects of static and corrective (to regain space loss) space maintainers?

Longitudinal documentation by means of oriented oblique films offers unparalleled opportunities for accumulation of valuable information supportive to clinical diagnosis and treatment.

Serial Extraction: Excesses of extraction, particularly in the hands of the uninitiated, do occur and are not to be condoned. Our investigations are not intended to promote promiscuous prescription of premature extraction of primary teeth. Instead, carefully considered criteria consistent with the best information available will be employed to order such extractions. Cephalometric documentation will be used to record the changes induced and evaluate the ultimate result.

In addition to these and other problems, our series now includes cases of partial and complete anodontia, growth disturbances and traumatic injuries. All such cases are being documented in the following manner:

1. Routine dental examinations, including study casts from alginate impressions plus frontal and lateral facial photographs.

2. Oriented lateral and frontal cephalometric films with the dentition in the following positions:

   a. Rest
   b. Occlusion
   c. During phonation of the vowel

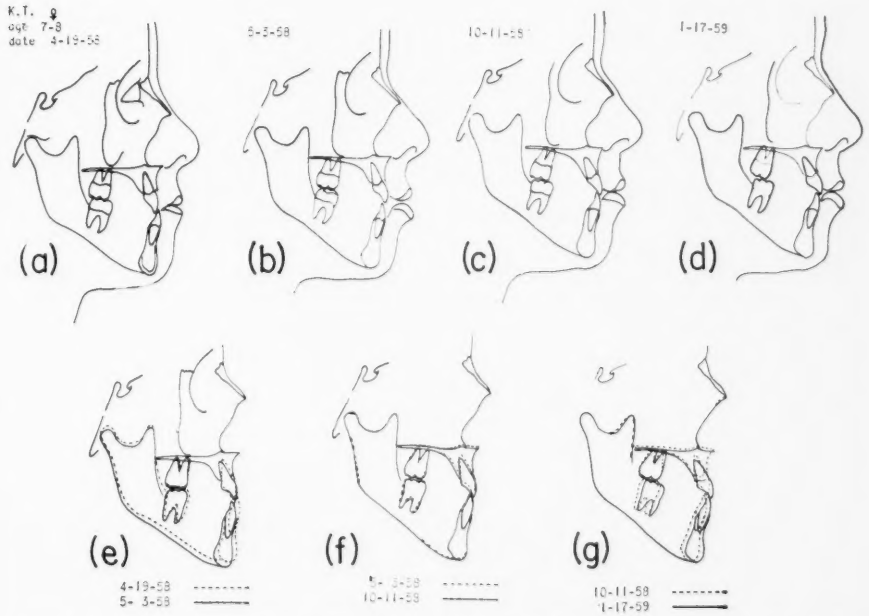

FIGURE 5. Tracings made from a series of lateral films depicting the correction of an anterior cross-bite by the use of an inclined bite plane. (a) Prior to treatment, (b) immediately following appliance removal, (c) and (d) represent follow-up records. The lower superimposed tracings reveal the response to treatment and the changes incident to growth. See text for detailed discussion.

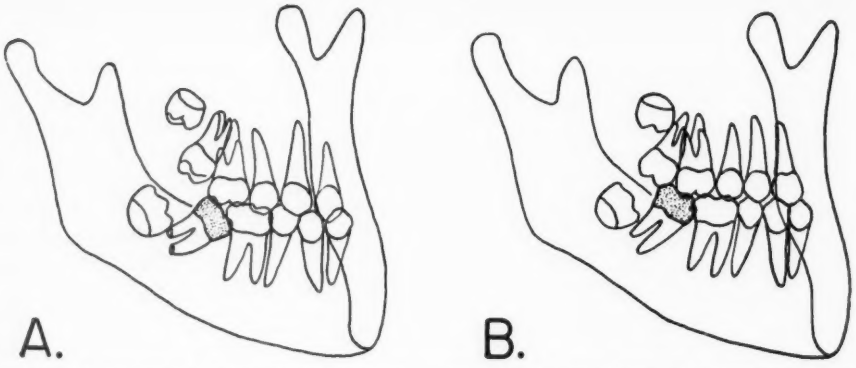

FIGURE 6. Tracings of oriented oblique films documenting the uprighting of an impacted lower left second permanent molar by the use of ligature expansion. (A) Prior to treatment, (B) subsequent to treatment.

(u) to determine bilabial approximation.

3. Oriented oblique cephalometric films both right and left.

4. Cephalometric analysis will be made on each child using the standard tracing and measuring techniques as well as other analyses specifically developed for these demonstrations.

5. Control measurements will be made on a comparable sample of normally developing children of same age and sex distribution.

6. Related measurements of the dentition will be made from dental casts.

The following cases were selected to illustrate the application of the cephalometric technic to some of the problems cited above.

Case No. 1. Figure 5 is of an anterior crossbite in a 7 year old girl. Standard lateral films were taken and tracings made of the films. The child was treated using an acrylic bite plane (inclined) over a period of two weeks. By comparing the top row of tracings (a-d) one can see the progress of the crossbite correction over a period of nine months. The first tracing (a) was taken before treatment was instigated and the right tracing (d) nine months later.

Lower left (e) is a superimposition of (a) and (b), or before treatment and immediately after treatment and appliance removal. Note the apparent bite opening evidenced by the lower border of the mandible as well as the changes in upper central incisor angulation. (f) presents superimposed tracings of the case immediately after appliance removal and those of five months later. The bite has remained open and changes in maxillary contours can be noted. In figure (g) the six and nine month film comparison revealed the changes in the axial inclination of the maxillary central incisors to accommodate the continual forward growth of the mandible.

It is hoped that through additional cases of anterior crossbites and their subsequent tracing and measurement definitive information may be gained regarding the mode of correction and the stability of the result obtained.

Case No. 2. This is of an impacted mandibular second molar treated by the

use of a brass ligature passed beneath and around the first and second molar contact (Fig. 6). At repeated intervals the ligature was tightened thereby producing a distal thrust against the impacted second molar. In this way the impaction was unlocked and the process of eruption restored. The lateral oblique film allowed visualization of the progress and subsequent tracing and measurement of superimposed films permits precise measurement of the change produced.

Case No. 3. This is an example of serial extraction initiated because of severe bimaxillary arch length deficiency (Fig. 7). Accordingly, extraction of the first bicuspids was ordered upon their eruption. Serial oblique films obtained at an interval of one year revealed the distal eruption pathway of the cuspids into the space previously occupied by the bicuspids. Although not indicated on the tracing, fixed appliances were employed to control the arch length provided in the extraction.

Other Clinical Adaptations: In addition to the numerous applications already cited, the lateral oblique film is an aid to the visualization of the temporomandibular articulation without the overlap from the opposite side as in the case of the standard lateral film.

Occasionally, the lateral oblique film has been found valuable as a substitute for intraoral x-rays of buccal segments where such films were not readily available as is often the case in the very young patient. In this fashion the oblique film provides a means of making a rapid dental survey.

IV. Summary

Although the pedodontist has always been in the forefront of the advance for improved child dental care, within the framework of pedodontic knowledge our preventive and therapeutic procedures have evolved somewhat in an empiric manner. Our daily practices include routine treatment of numerous conditions which we have grown to accept without question when in reality little is actually known of the mechanisms of action involved incident to the treatment. The present emphasis on preventive therapy

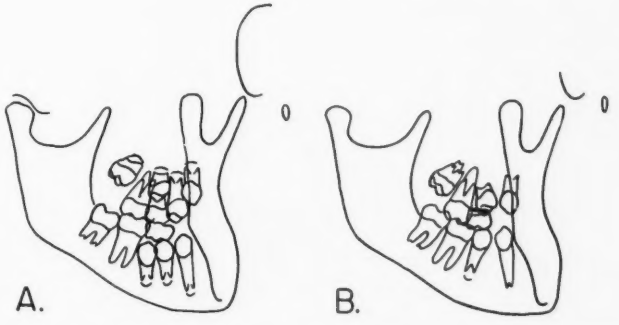

Figure 7. Tracings of oriented left oblique films revealing the patterns of eruption in serial extraction therapy. (a) Prior to extraction of first bicuspids. (b) One year later the cuspids are shown to be migrating distally into the space provided by the extraction and maintained by holding arches.

throughout the dental profession requires advanced knowledge based upon sound fundamental research rather than empiric rationale.

It seems apparent that the use of roentgenographic cephalometry may produce an appreciation for our present pedodontic rationale or, on the other hand, may indicate the necessity for change in our present modes of treatment.

It is our feeling that long-term evaluations of pedodontic therapy are necessary. The technic discussed is particularly adaptable and since this presentation is intended as a progress report describing work underway, we hope the paper may serve as a stimulus for others to join in the effort. Certainly, similar but independent investigations are necessary if all of our questions are to be answered and pedodontics becomes identified with a broader tradition of research.

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Pulp Testing: an Evaluation of Various Technics*

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SCIENTISTS have reached a high degree of accuracy in measuring many physiological phenomena, but the vitality of the human dental pulp does not seem to be one of the phenomena that can be measured precisely. The purpose of this paper will be to present the various methods of pulpal testing and evaluate each of them on the basis of reports in the available literature. Conclusions in each instance will be stated.

It appears sensible to evaluate the four methods of pulpal testing that have been utilized: (1) thermal, (2) mechanical, (3) electrical, and (4) physiometric.

1. THERMAL TECHNICS

Thermal testing of the dental pulp is accomplished by the application of heat or cold. Cold usually is applied to the tooth either by the use of ice or a pledget of cotton sprayed with ethyl chloride until ice is formed. Ethyl chloride acts as a refrigerant when sprayed on cotton if it is allowed to evaporate rapidly in air. It condenses moisture from the air which freezes on the pledget of cotton. This cotton pledget, applied to the tooth, should elicit the same sensation that ice does. Cold may be applied to a tooth with considerable control. If mechanical refrigeration is available, ice cones easily may be prepared by trimming about two inches off the wide end of a vortex cup and leaving a pointed paper cone that will fit into the cube-former of a standard tray. These cones, filled with water, are placed in the cube-former until the water freezes. They are made ready for use immediately. The paper is torn off the point and the wide end is wrapped in soft paper. This technic produces ice in a convenient form for using on the occlusal, buccal, labial, or lingual surfaces of any tooth. Ice is a material with which all patients are familiar, hence, its application does not cause fear or anxiety. Patients who refuse the electrical test readily submit to the test with ice, hence it serves as a valuable material for testing the teeth of children because of the psychological false-positive responses that may follow the first electrical test. Ice also is helpful in testing teeth that have large restorations and crowns. No preparation of the teeth is necessary and the teeth need not be dry or clean. The use of ice consumes little time and is accepted by some reporters[1] as more accurate for treating than any other externally applied stimulus.[10]

To apply heat to the tooth, a piece of gutta percha two to three mm. in diameter is fastened to the plugging end of a Woodson No. 3 plastic instrument or any other plugger of similar size and shape. The gutta percha is passed through a gas flame until it is heated evenly and softened throughout; then it is applied immediately to the tooth. The temperature of the heated gutta percha is within the limits of the tolerance of the pulp. Teeth which react violently to cold also should be tested by heat.[10]

The sensation in the dental pulp probably is produced in two ways: (1) by irritation of the dentinal fibrils which

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convey the impulse to their cells around the periphery of the pulp and which in turn, the cells convey the impulse to the sensory nerve-endings in their immediate vicinity; or (2) by a disturbance of the vasomotor function of the pulpal vessels which causes interstitial pressure that directly affects the sensory nerve-ending. Although it is difficult to tell how a sensation is produced at a given instant, it is probable that some form of hyperemia or other vascular disturbance occurs when the pulp is irritated by any thermal stimulus.[10]

The pulp resembles an internal organ. It has no sense of touch or localization and it responds to various stimuli only by the sensation of pain. Pain usually is located correctly with reference to the midline but other than that response, it is located only as it is directed to some known lesion. The dental pulp is especially sensitive to sudden changes in temperature, hence, this reaction is utilized in pulpal testing.[10]

Via,[10] and Austin and Waggener[1] feel, after their review of research, that cold is the test of choice and when cold stimulates a violent reaction, that heat should be tried.

Thermal testing of pulps has two disadvantages: (1) it is difficult to tell how cold the tooth becomes, inasmuch as the operator cannot know how much cold is applied to each tooth when the amounts of heat lost vary with the different quantities of cold being applied, and (2) standardized device of measuring that will provide the same reading at two different appointments has not been developed.

2. Mechanical Technic

The mechanical method of pulpal testing is utilized by preparing a cavity in a tooth as a test. It may be the beginning of a routine preparation for a needed restoration, previous to the administration of anesthesia, or it may be a small gingival cavity prepared exclusively for determining pulpal vitality. Rarely is it necessary to resort to this method of pulpal testing. Like the application of heat and cold, this method has no measuring device to correlate results with readings from one time to the next.[10]

3. Electrical Testing

Of all the different types of tissue present, the neural fibers are the most resistant to inflammatory or degenerative changes. In view of this finding, it would seem that definite pathosis could exist within the pulpal structure without completely destroying the neural fibers. One readily can appreciate how a response sometimes is obtained by irritation even though the tooth, however, will be different from the response of a normal tooth to exactly the same irritation. It therefore is extremely important that the form of irritation used must be so controlled that it can be reproduced identically on the questionable tooth as well as on other teeth in the mouth, so that a variation in response indicating a diseased pulp can be detected. Bearing this necessity in mind, it would be extremely difficult to standardize irritations from thermal changes precisely. One needs only to recall the variations produced by heated instruments, heated gutta percha, or the application of ice, or the spray of ethyl chloride, or the mechanical irritations produced by percussion or drilling a hole in the crown.[5]

When producing electrical irritations, the problem of standardization is simpler. Therefore, of all the methods available, the electrical test should be by far the most practical and reliable. Reiss

and Furedi[8] experimented with two kinds of instruments for pulpal testing and found that the simplest and most satisfactory device was the one having a single-prong electrode, sufficiently small to apply conveniently to any surface of the tooth. The other electrode was provided by a medium-sized metal cylinder which the patient clasped in either one or both hands, after removing rings from his fingers. Both electrodes extended by wires from a small rheostat conveniently marked from 0 to 100 with a control or potentiometer that could be moved along easily to raise the voltage as slowly as desired. The apparatus did not appear very formidable or pretentious and did not seem to frighten the patient unduly. These investigators conducted their pulpal testing on 130 teeth which were recorded as normal or abnormal in their response to the tests, then extracted and microscopic sections made of the pulpal tissue.[8]

Kaletsky and Furedi,[4, 5] checked two different types of instruments, Type I was the same as that used by Furedi and Reiss and Type II was a bipolar instrument with two dental electrodes. One pole touched the tooth on one side and one on the other. Their results from testing with Type II when compared with the Type I provided the following data: (1) testing with Type I provided an accuracy on incisors of 99 per cent; (2) the testing with Type II provided an accuracy on incisors of 99 per cent; (3) bicuspids, with Type I testing revealed an accuracy of 95 per cent and Type II 94 per cent; (4) with molars, Type I testing obtained an accuracy of 65 per cent and 75 per cent with Type II; (5) instrument for Type I testing was reliable in determining pulp pathosis to a level of accuracy of 91 per cent, whereas the instrument for Type II was inaccurate in detecting pulpal pathosis except for necrotic pulps; and (6) lack of response to an electrical stimulus with either instrument denoted a necrotic pulp. Both of these instruments had a voltmeter so that the amount of volts registered would be constant and readable. Each also had a milliamperemeter to show whether the tooth was getting the current that should be passing through it. These investigators found that the amount of moisture on the electrodes making the connection would cause a different amount of voltage to reach the tooth and that it was necessary to control this factor in pulpal testing.[4] A unipolar electrode with a reservoir containing cotton was used and described by Mumford.[6]

Ziskin and Zegarelli[12] used an apparatus having a single pole or a single prong as an electrode with a hand-electrode. In this device, they had a voltmeter and a micro-amperemeter which they felt was more important than the voltmeter. The stimulating current traversed a circuit composed of the enamel, the dentin, the sheath about the nerve, and the skin. The resistance was connected in series and they found that the resistance of enamel and dentin varied greatly from person to person and from tooth to tooth as a result of wear, degree of calcification, and secondary changes. The resistance of the sheath surrounding a nerve did not change except in instances of associated gross pathology. When a threshold current passed through all the areas of resistance in series, the drop in potential across each area was equal to the current passing through it times the value of its resistance. The drop in potential across the enamel and dentin was variable depending on its thickness, calcification, and some other conditions, and while the drop across

the neural sheath depended on its constant resistance. By measuring the current through the entire system an idea was gained of the potential voltage stimulating the nerve. Actually the principles utilized were much more complicated than the simple description stated here suggests, but the generalities are applicable. Were the entire voltage across the system to be measured instead of the current through it, the sum that the potential dropped across each area of resistance could be obtained. Since the drop across the enamel and dentin was so variable there was no way of determining the part of the total voltage to apportion to them and the part to attribute to the internal sheath. Therefore, it seemed that there was a theoretical justification for measuring of threshold-currents rather than threshold-voltage.

Most of the testers of pulpal vitality sold commercially are calibrated in volts, either for direct readings of the meter or by divisions on a sliding scale. The report of Ziskin and Zegarelli[12] describes the equipment and the methods of electrical pulpal testing employed and lists the findings from actual tests of 1,605 teeth.

They found that there was about an 11 per cent difference only in readings of voltage and microamperage. This minor variation provides little justification for abandoning the common reading of volts in favor of the reading of microamperes. They concluded that measurement of voltage was a better indicator of the resistance of teeth than was the threshold of pulpal irritability, since the voltage necessary to overcome the resistance of teeth is proportional to it. The periodontal membrane was found to be an irritable tissue which could be stimulated by electricity. There was no provision in instruments designed for reading volts to detect such responses. Consequently, reactions often were misinterpreted as vital pulpal reactions. In order to obtain quantitative measurements of pulpal irritability, it was necessary to test at the threshold. Errors in technics such as those produced by leakage of current, breaking of wires, and other mechanical defects were not discernible in machines recording volts because there was no provision made for determining whether current actually was passing through the pulp.

Ziskin and Wald[11] stated the same conclusions as Ziskin and Zegarelli.[12] These investigators concluded that a tester be developed measuring volts, together with a tester for measuring current, in order to determine if the complete amount of current was going through the tooth and overcoming the resistance of the enamel, dentin, the sheaths of neural fibers and the skin. They conducted a test of 200 questionable and controlled teeth with the apparatus for reading the current and found that 49 teeth were non-vital. This finding was confirmed by repeated readings, radiographs and extirpation of pulps. Of the remaining 151 vital teeth, readings were repeated closely by 135 teeth. Sixteen tests disclosed variations great enough to be regarded as discrepancies. In the entire series, identical readings were obtained in 102 teeth.

In tests of six vital teeth, the high-frequency vitalometer was found to be accurate to a $\pm$ 0.36 degree of variance. This figure was significant for the teeth tested but should be repeated on a significant sample.[9]

The literature studied indicated that electrical pulpal testing was the only method which had been checked by extirpating the pulps and studying micro-

scopic sections. The greatest disadvantage of electrical pulpal testing seems to be the psychological effect it may exert on the patient. After a little explanation, most patients can be induced to accept an electrical pulpal test and, after a few false recordings, suitable responses usually can be obtained.

4. Physiometric Testing

Physiometric pulpal testing is one of the newer methods of testing and, as yet, has not been completely developed. There are two different types of testing described in this report. One is a measurement inside the pulpal tissue and the other is a photographic technic for measuring the circulation inside the tooth.

The preliminary study to determine the temperature of the tooth and supporting structures was made by means of electronic devices in an attempt to establish the normal temperature in the oral cavity. The investigator applied highly sensitive devices (thermistors) which recorded changes of 0.0005° centigrade. The possible existence of differences in temperature during the stages of pulpal pathogenesis is planned for a future study. The preliminary findings in acute irritations of the pulp indicate that a definite rise in temperature occurs in the affected tooth. An uncomplicated clinical test for securing the temperature of teeth may be devised in the future, but, until it is available, a correctly understood pulpal tester is an invaluable and indispensible addition to diagnostic technics.[7]

The other method, be reminded, was based on photometry. Ideally a pulpal test should be objective and concerned primarily with the circulation in the dental pulp. Reich[6] has applied objective photometry in the determination of circulatory changes in intact teeth. Initial experiments point to a successful application of this method. The basis of the method follows: (1) when light is passed through a solution of hemoglobin, a selective absorption of certain wave lengths occurs, and varies in degree with the concentration of the pigment; (2) changes in the transmission of light can be measured by means of a barrier-layer photo-electric cell in a galvanometer; and (3) the sensitivity is increased by the use of a filter to isolate a normal band of wave-lengths equally absorbed by an oxygenated and reduced hemoglobin. Applying these observations to the dental pulp, it is assumed that warming a tooth will cause dilatation of the vessels in the pulp. With a consequent increase developed in the total amount of hemoglobin in the path of the transmitted light, the amount of current produced by the photocell should decrease. It appears possible to correlate variation in the responses of the photocell with the ability of the vessels in the dental pulp to undergo active variation in diameter. A dynamic process occurring in the dental pulp of an intact tooth thus is demonstrable.[2] This method of checking provides possibilities but will require more investigation to develop a useful technic.

It may be suggested that the physiometric methods of pulpal testing are feasible but that they require confirmation and correlation until their reliability is thoroughly established.

Conclusions

1. Pulpal testers with a single-pronged dental electrode and a hand electrode seem to be the most accurate devices now available for testing.

2. Both threshold-current and threshold-pressure should be measured.

3. Apparatus for pulpal testing is available which has a high degree of accuracy for testing single rooted teeth.

4. New electronic devices are available which make it well within the realm of possibility that a device which measures the dynamic processes within a tooth may be developed in a suitable form.

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The Dental Cements; a Review of Their Physical and Chemical Properties*

A COMMITTEE of members† of the American Academy of Pedodontics was assigned the task in 1956 of reviewing critically the literature available on the physical and chemical properties of the dental cements. The cements studied were (1) zinc-phosphate, (2) siliceous, (3) copper, (4) zinc oxide-eugenol, and (5) resinous compounds. Since temporary stoppings of gutta percha still are reported in dental literature, the properties of (6) gutta percha were included in this review.

1. Adhesiveness or Retention

Strictly speaking, adhesion refers to molecular attraction between unlike molecules. This type of adhesion does not exist between the dental cement and the tissues of the tooth.[44, 2] In a broader sense, adhesion can refer to a mechanical interlocking such as the glueing action in joints of paper or wood. Dental cements flow into the irregularities in the surfaces of the cavity and the appliance being cemented and thus lock the appliance in place. To remove the appliance it is necessary only to shear off these numerous minute extensions. The compressive strength of the cement has some relation to the degree of mechanical retention, as do other factors such as dimensional changes produced in the cement by shrinkage during hardening, by loss or gain of water and by thermal expansion of the tooth and the cement. The lower the surface-tension the better the penetration of the plastic cement into the very minute irregularities of the surface being cemented.[23] Highly polished surfaces do not exhibit as great retention, when they are bonded with dental cement as do slightly roughened surfaces.[3] Swartz and Phillips[51] demonstrated greater adhesive characteristics for resinous cements than for zinc-phosphate cements on a prepared dry dentinal surface. Since the resinous cements have a low surface-tension this property may account in part for the excellent bonding action when kept dry. However, this high adhesiveness was lost rapidly as soon as the resinous cement became saturated with water.

2. Ability to Resist Marginal Penetration by Saliva

A study by Grossman[8] revealed that temporary stopping, baseplate gutta percha and zinc-phosphate cements either alone or in various combinations are not peripherally impervious to the penetration of solutions of dyes or to suspensions of bacteria. He found, however, that saliva penetrated more slowly. Cements having a base of zinc oxide-eugenol were found to be hermetic under all conditions of the test. As a group, the zinc oxide-eugenol cements appeared to be the best, zinc-phosphate cements the worst, and fillings of modified gutta percha occupied an intermediate position in preventing peripheral leakage. Massler and Ostrowsky,[17] from a study of the sealing qualities of various filling materials tested in vitro, reported that

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† Wilfrid Feasby, Elsie Gerlach, Benjamin Kletzky, Mary K. Martin, Ruth Martin, Maury Massler, and Arthur W. S. Wood, Chairman.

marginal leakage occurred within 24 hours when base-plate gutta percha, temporary stopping, zinc-phosphate cements and self-curing acrylic resins were used as fillings. Siliceous cement preserved its marginal seal somewhat longer (up to three days). Zinc oxide-eugenol and amalgam exhibited the most effective marginal sealing. All types of cements appear to stain eventually in the mouth. Leakage of food and microorganisms between the cement and the walls of the cavity probably produce the darkening of both the dentin and the cement.[24] Both the siliceous and the resinous cements stain by the action of material invading the margins between the walls of the cavity and the restoration.[28]

Nelson, Wolcott and Paffenbarger[19] have called attention to the exchange of fluid that takes place at the margins of every restoration subjected to alternating changes in temperature. A patient drinking iced water at 4°C., and hot coffee at 60°C., developed a change of temperature in the filling from 9°C. to 52°C. Droplets of moisture were observed at the cavo-surface margins. Since the filling material contracts sometimes seven times as much as the substance of the tooth, it was calculated that a space of 10 microns might develop at the junction between the filling and the tooth.

3. Linear Change From Hydration, Dehydration and Rehydration

(After final setting)

Probably it is appropriate to review these definitions at this point:

(1) *hydration* is the chemical union of the substance with water;

(2) *dehydration* is the loss of water; and

(3) *rehydration* is the regaining of water after its earlier loss.

Crowell[5] has shown that set zinc, copper and siliceous cements shrink on further dehydration, that they thus are changed permanently and that they do not rehydrate. These chemicals, therefore, should not be allowed to dry out after setting, since drying of the surface results in shrinkage and crazing which will lead inevitably to disintegration. Souder and Paffenbarger[45] found that moisture, coming in contact after the set is complete, does not impair the surface appreciably and may produce a slight, helpful expansion of siliceous cement. Crowell[5] states that zinc oxide-eugenol cements and gutta percha are not changed by dehydration. The direct filling resins do not shrink badly after they are set unless dried out for long periods of time. The resins return to their original dimensions on absorption of the water lost during drying.[28]

4. Solubility in Saliva

Clinical observation has shown that siliceous cements are much more durable in the mouth than the zinc- and the copper-phosphate cements, yet the siliceous cements are more soluble in distilled water than the phosphate cements.[23] It may be concluded that the tests employed for solubility do not duplicate oral conditions. Present in the mouth are corroding agents such as organic acids, ammonia and sulfides. Zinc-phosphate cements are attacked readily by sulfides but the siliceous and resinous cements are not. This finding may account for the greater permanence of siliceous cements in the mouth even though they are more soluble in water.[32] The tests in water are valuable only when cements of the same type are being compared. The solubility and disintegration of these cements in distilled water for seven days at 37°C. follows:

Class of Cements	*Consistency*	*Solubility and Disintegration* % BY WEIGHT
1. Zinc oxide-eugenol	Filling	0.02-0.1[20]
	Filling	0.05[20]
2. Zinc-phosphate	Cementing	0.17-5.0[55]
	Filling	0.05[20]
3. Copper-phosphate		
Red	Cementing	0.5[54]
	Filling	3.7[20]
Black	Cementing	0.3-3.5[54]
	Filling	0.6-5.0[21]
4. Siliceous	Cementing	0.14-1.0[22]
5. Zinc-silicate	Filling	0.2[21]-2.1[20]
6. Resinous	Cementing	0.0-0.4[32]

5. Necessity of Protecting Surfaces During the Process of Setting

The effect of moisture on the surface layer of zinc-phosphate and copper-phosphate cement prior to the complete set is a serious matter.[46] If the cement comes in contact with water prior to the completion of its chemical reaction, it will not develop a smooth, hard, glossy surface. The surface will be dull, soft and easily dissolved by oral fluids.[36]

Water, on the other hand, accelerates the setting of zinc oxide-eugenol.[37] Crowell[5] states that zinc oxide-eugenol cements and gutta percha must be placed in dry cavities so that no film of water will be present between the material and the walls of the cavity. Being placed is this manner, they then may be exposed to saliva without damage.

Siliceous cement will not set properly in the presence of water. When this cement is exposed to water prematurely the phosphoric acid is leached out, and the water replaces it in the weak gel which is being formed as a framework. Swelling takes place and the surface of the restoration is ruined irreparably.[38]

Water incorporated in the resinous cements before and during their polymerization increases the rise in temperature and decreases the period of polymerization.[31] The incorporation of water should be avoided since the shade of the restoration may be affected. If the resin contains P-toluene sulfinic acid and is contaminated by saliva the resin will not set properly.[15]

6. Temperature Developed During The Process of Setting; Its Variation With the Consistencies Of the Mixed Materials

Zinc-phosphate and copper-phosphate cements generate heat during setting.[5] The increase in temperature during the process of mixing and setting depends upon the rate of reaction of the phosphoric acid, the size of the mix and the absorption of heat by the mixing slab. A laboratory test using zinc oxide and phosphoric acid in a rubber mold caused a rise in temperature as much as 13°.[47] Under clinical conditions the rise in temperature is small. Gutta percha, of course, must be heated to soften it for application.

The rise in temperature of resinous cements on setting in a cylinder ranges from 10° to 41°C.[33] Under clinical conditions the amount of cement is so small that no danger of overheating the pulp should be anticipated. The temperature attained by the resin on setting will depend on (1) the temperature of the environment in which the resin polymerizes, (2) the rate of polymerization, and (3) the bulk of the restoration.[39]

7. Thermal Conductivity After Setting

Dental cements, because of their low thermal conductivity, can be used to prevent or decrease a thermal shock

which appears when metal fillings are placed near the pulp. Conductivity of dental cements is between 0.01 to 0.005 as conductive as alloys akin to those used in making inlays.[48]

8. Electrical Conductivity

Phillips, et al. found all cements good insulators when dry. Resinous and zinc oxide-eugenol cements remained good insulators even under wet conditions. However, when zinc-phosphate cements and calcium-hydroxide liners become wet they fail to insulate against galvanic action.[30]

9. Reaction of Filling Material To Thermal Change

Zinc- and copper-phosphate, siliceous and zinc oxide-eugenol cements have low coefficients of thermal change at temperatures below 50°C. when tested in water.[5] The reaction of these materials to thermal changes when used as fillings, therefore, is not significant.

Paffenbarger[29] states that there is a marked change in the dimension of resins when changes in temperature take place. A patient drinking ice water at 40°C. and hot coffee at 60°C. caused the temperature of the filling to change from 9° to 52°C. The rise of 43°C. causes the filling to expand and a fall of 43°C. causes it to shrink. The resinous filling expands and contracts seven times as much as the tooth and it is calculated that a space of 10 microns may develop at the junction of the filling and the tooth.[19]

10. Time Required for the Process of Setting and Its Variations With the Consistency Of the Mix

A reasonable time for *zinc-phosphate cement* to set is seven minutes plus or minus four minutes at mouth temperature. The time of setting can be decreased by using a warm slab, by incorporating the powder rapidly, by increasing the amount of powder in the mix, by grinding the powder finer, or by increasing the amount of water in the liquid. The time of setting may be increased by using a mix of thin consistency, by using a cold slab, by incorporating the powder slowly, by increasing the time of mixing, by using a coarse powder, or by decreasing the amount of water in the liquid.[49] The specifications of the American Dental Association for zinc-phosphate cements states the time of setting cannot be less than four and not more than 10 minutes.[1]

No definite reference could be found for *copper cement* but it is thought to be essentially similar to zinc-phosphate cement.

According to Specification No. 9 of the American Dental Association, the time for setting of *siliceous cement* at 37°C. should be between three and eight minutes. The time of setting is influenced by the composition of the powder and liquid. The finer the powder, the faster the cement will set. The longer the mixing time, the longer is the setting time. The less liquid with the same amount of powder, the shorter is the setting time. The addition of small amounts of water decreases the setting time. The temperature during mixing affects the time of setting in that the lower the temperature of the slab, the longer will be the time of setting for the cement.[40]

The greater the amount of *zinc oxide* incorporated with *eugenol* the faster the material will set. The lower the temperature of the slab, the longer the time of setting provided the temperature is above the dew point. Water accelerates the setting reaction of this cement as does a

number of chemical substances. Zinc oxide and eugenol alone may require 30 minutes or more to set. Catalysts accelerate the setting as well as the compressive strength considerably. The most effective accelerates are zinc acetate and acetic acid, although a number of substances will accelerate the set.[5]

A reference regarding the behavior of *gutta percha* could not be located.

The time of setting of the resinous cements tested showed a much narrower spread than either the zinc-phosphate or siliceous cements. Resinous cements are far less critical than the zinc-phosphate cements in variation of time of setting among different consistencies of the mix. Substances like eugenol interfere with or even prevent the polymerization of self-curing acrylics.[34]

11. The pH Developed During The Process of Setting

The pH of *zinc-phosphate* cement at the time of insertion is approximately 1.6.[9] As the reaction proceeds the pH increases and the final pH of the cement after approximately 24 hours is about 7.0.[7]

The acidity of the *siliceous* cement is considerable (pH 1.6) when it is placed in contact with the tooth. When measurements are made with the cement in distilled water, the acidity decreases rapidly in most instances as the silicate hardens. It approaches neutrality in 24 hours under such conditions of testing.[9]

The hydrogen ion concentration of five *zinc oxide-eugenol cements* as tested was between 5.0-9.4 in the plastic state.[10]

The pH of *copper cement* as tested on insertion was about 1.72 and 6.5 after 21½ hours of setting.[11]

No references could be located to secure similar information about the resinous cements and gutta percha.

12. Resistance to Compressive Stress

The compressive strength of seven-day-old specimens stored in distilled water at 37°C. follows:

	Consistency	*lb./in.*
Zinc oxide-eugenol	Filling	2,000-5,500[20]
Z.O.E. with accelerator	Filling	19,000[20]
Zinc-phosphate	Cementing	6,000-12,000[23]
Copper-phosphate (Red)	Filling	21,000[20]
	Cementing	14,000[24]
Copper-phosphate (Black)	Filling	9,000[20]
	Cementing	6,000-22,000[24]
Siliceous	Filling	10,500-21,500[21]
Resinous	Cementing	7,500-12,500[32]

Observations in the mouth have shown that the durability in withstanding masticatory forces arranges the cements in roughly the following order (the least durable first): zinc oxide-eugenol, zinc- and copper-phosphate cement and siliceous cement. The resinous cements have not been used long enough to provide adequate clinical experience.[23]

13. Type of End-Product Produced During Setting

The set *zinc-phosphate cement* contains unreacted powder with zinc and aluminum phosphates.[6] It is crystalline in structure with the undissolved powder particles suspended in the crystals of zinc phosphate and some other products of the reaction. It is a cored structure.[8]

The *siliceous cements* have a cored structure which results from the setting of this type of cement. The core is composed of undissolved particles of powder and the matrix is essentially a gel of silicic acid.[41]

The set *copper cement* contains un-

reacted powder with zinc, magnesium and copper phosphate.[34]

The set *zinc oxide-eugenol* cement is unreacted zinc oxide and eugenol plus zinc eugenolate.[4]

Gutta percha and temporary stopping are unchanged by heating and cooling.[5]

Acrylic cements and direct filling material result in acrylic polymers with inert mineral fillers.[32]

14. The Breakdown of End-Products as Time Lapses

Clinical observations have shown that siliceous cements are much more durable in the mouth than zinc-phosphate cements. Oral corroding agents are produced such as organic acids, ammonia and sulfides, depending upon the flora and the nutrients available. Some of these agents selectively attack one class of cements. Zinc-phosphate cements are readily softened by hydrogen sulfide, but siliceous cements are not.[23]

Although free acid is known to be injurious to the dental pulp, no reference was found to determine whether the breakdown products of the cements have any effect on it.

PRINCIPAL INGREDIENTS AND TYPES OF END-PRODUCTS PRODUCED

Type of Cement	*Composition*		
	POWDER	LIQUID	SET CEMENT
(1) Zinc oxide eugenol	Zinc oxide (uncalcined) zinc acetate resin.[32]	Eugenol with mineral and/or vegetable oils as diluents.[32]	Unreacted zinc oxide and eugenol plus zinc eugenolate.[4]
(2) Zinc-phosphate	Calcined zinc oxide and magnesium oxide. Sometimes salts of copper, silver or mercury.	Orthophosphonic acid plus aluminum phosphate and/or zinc phosphate.[22]	Unreacted powder with zinc and aluminum phosphate.[6] It is crystalline in structure and cored.[9]
(3) Copper-phosphate Red	Class (2) with some cuprous oxide.[34]	Class (2).[34]	Unreacted powder with zinc, magnesium and copper phosphates.[34]
(3) Copper-phosphate Black	Cupric oxide, cobalt oxide, with or without class (2).[34]		
(4) Siliceous	Complex glass alumino-silicates containing magnesium, fluorine calcium, sodium and phosphorus.[35, 21]	Class (2) with less acid and more water.[21]	Non-crystalline gel, largely of silicic acid.[20] Set cement has a cored structure.
(5) Resinous	Acrylic polymers mineral fillers.[32]	Acrylic monomers.[35]	Acrylic polymers and inert mineral fillers.[35]

(6) Gutta percha is unchanged by heating and cooling.[5]

14. Demonstrated Injury to Pulpal or Gingival Tissues and Control by Modification and Technics of Manipulation

A survey of the literature showed that the approximate order of cements in relation to their irritating effects on the pulp, from the least to the most severe, is zinc oxide-eugenol, zinc-phosphate, siliceous, and copper cement.[26] The literature exhibits considerable controversy on the degree of irritation caused by the self-curing resins. Both laboratory studies and clinical experience are cited.

However, an extensive study by Johnson[14] of one resin cement indicated that the properties were favorable. A study of the cements by Massler and Silberkweit confirmed the order of irritability as already reported.[16]

Jensen and Zander[12] found a definite reaction of the gingival tissues to zinc-phosphate cement but none to resinous cement.

15. Discoloration of the Teeth

Crowell[15] has stated that he has not seen any discoloration of the tooth from the cements. However, chemical considerations alone of cements containing copper would make one expect more discoloration than from cements without it. All classes of cements appear to stain eventually in the mouth. Leakage of food and microorganisms between the cement and the walls of the cavity usually results in a darkening of both the dentin and the cement. When impurities of base metals are present in cements, darkening occurs in the presence of sulphides.[24]

16. Ease and Convenience of Manipulation

Crowell[15] has stated that he considers there is little choice between the phosphate cements regarding ease of manipulation. Johnson, Phillips and Swartz[13] found that the working characteristics of resinous cements were better than those of zinc-phosphate cements since they provide slightly more working-time and their technic of mixing is less critical than that for the other cements. Skinner[42] stated that the acrylic cements have an advantage over other cements since their rate of addition of the powder to the liquid is unimportant.

17. Dimensional Changes

Most materials shrink when they change from a fluid to a solid state. Unfortunately, the cements are no exception. Quantitative data on the dimensional changes for the zinc-eugenol cements were not found in the literature, but data on the zinc oxide-eugenol impression pastes[43] showed that most of the brands shrank somewhat. One brand exhibited a slight expansion. All of the cements using phosphoric acid as the liquid shrink on setting unless there is premature contact with water. The acrylic cements shrink a comparatively large amount depending upon the amount of monomer present in the mix. According to Grossman[8] zinc oxide-eugenol cement hermetically sealed off glass tubes against the penetration of dyes and bacteria, while gutta percha, temporary stopping, and zinc-phosphate cement did not.

The cements utilizing phosphoric acid as liquids, shrink in air after hardening and, therefore, must be kept under water or saliva.[24] The resinous cements shrink a comparatively large amount depending on the amount of monomer present in the mix. The hardened resinous cements are stable in air but expand on absorption of water.

18. Opacity

Cements, used as filling materials and as luting media for translucent restorations, should have optical opacities falling in the range of the average opacities of dentin (70%) and enamel (39%). Only siliceous and acrylic cements come within this range.

A cement that has a high radiopacity is required if unremoved or recurrent decay is to be distinguished from the cement in the radiograph. Zinc-phosphate cement has a satisfactory radiopacity. Resinous cements can be formulated to equal the radiopacity of zinc-phosphate cements. Siliceous cements are not sufficiently radiopaque, but to make them so probably would destroy the optimum optical opacity.[25]

19. Technic of Mixing

It is good practice in mixing the cements—zinc oxide-eugenol, zinc phosphate, copper phosphate, zinc silicate and siliceous cement—to incorporate the maximum amount of powder in the liquid. Thus the powder will be present in a large excess within the set cement and the particles of powder will be bound together by the matrix formed by the reaction between the liquid and the surface of the particles of powder. It is this matrix that is soluble, that is weak, that shrinks, that irritates the pulp and which absorbs stains. The powder itself is comparatively stable in all of the foregoing aspects. Therefore, any practice that will keep the matrix to a minimum, yet give a workable consistency, will result in a more satisfactory cement. The design of any technic should center around this concept.

The zinc oxide-eugenol cements set by the formation of zinc eugenolate. There is always an excess of zinc oxide and eugenol in the set cement. Water is necessary for the setting reaction. If a mixture of zinc oxide and eugenol is kept over a desicoating agent, the cement will remain plastic for hours. When it is placed in the mouth, the exposed surface comes in contact with the moisture in saliva and setting is accelerated.

The zinc- and copper-phosphate cements should be mixed on a cold slab if possible and for approximately 1½ minutes. The increments of powder should be small. If the mixing is carried out slowly on a cold slab, the reaction between the powder and liquid proceeds at a slower pace and considerably more powder can be incorporated for a given consistency than if mixing is carried out on a warm slab. Since the zinc- and copper-phosphate cements set by the formation of new chemical compounds, with the liberalization of heat, slow mixing also is important to reduce the effects of this heat on the pulp.

The siliceous cements set by the formation of a non-crystalline gel which should not be disturbed after formation. Therefore, siliceous cement should be mixed quickly (not longer than 30 seconds) on a cold slab or preferably in a closed container (cooled under water) to prevent effects of exposure to the atmosphere. Such practices give the maximum powder-liquid ratios which in turn produce the best qualities of the hardened cement.

As the phosphoric acid liquids are hygroscopic, mixing should proceed immediately after depositing the liquid on the slab. Likewise, the surface of the slab used for mixing should be kept to a minimum. Such practices minimize the loss or gain of water from the liquid which adversely affects many properties.

It is not necessary to spatulate the

resinous cements in the customary manner. The powder may be placed in a small medicine dish and the liquid may be added drop by drop until the powder is wetted. Stirring this mixture gently for five seconds with the spatula is ample.

All the cements should be used as quickly as possible after the mixing is completed.[27]

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—Pleasure for All

Help Us to Do It!

Pre Register—NOW

PROGRAM AT A GLANCE
Ambassador Hotel—Los Angeles, Calif.
October 14, 15, 16, 1960

FRIDAY, OCTOBER 14

12:00 Noon-6:30 P.M.	Registration
3:00 P.M.	Executive Council Meeting
4:00 P.M.	Welcoming Party (You will be guests of S. Cal. Unit)
6:00 P.M.	Exec. Council Meeting (for Exec. Council Members only)

No Planned Program for Evening

SATURDAY, OCTOBER 15

9:00 A.M.	Registration
9:00 A.M.-10:30 A.M.	Registered Essay Program
9:00 A.M.-12:00 Noon	Visual Education
10:30 A.M.	Orange Juice Break
10:45 A.M.-12:00 Noon	Table Clinics
11:00 A.M.	State Secretaries Meeting
12:00 Noon	Ladies Luncheon & Fashion Show
12:30 P.M.	Scientific Luncheon
2:00 P.M.	State Delegates Meeting
3:00 P.M.	General Membership Meeting
6:30 P.M.	Cocktail Party
7:30 P.M.	President's Banquet

SUNDAY, OCTOBER 16

9:00 A.M.-10:30 A.M.	Registered Clinics
10:30 A.M.	Orange Juice Break
10:45 A.M.-12:00 Noon	Table Clinics
11:00 A.M.	State Secretaries Meeting
12:30 P.M.-1:30 P.M.	Lunch—On your own
2:00 P.M.-4:00 P.M.	Panel Discussion "The Changing Pattern of Dental Practice"
2:00 P.M.	Ladies Program
4:30 P.M.	Farewell Party

NOTICE

If you have not already sent to A.D.A. a request for housing, fill out the form below and mail immediately to A.D.A. Housing Bureau, P.O. Box 5440, Chicago 7, Illinois. (Any application you may have sent to A.S.D.C. should be disregarded.)

PLEASE PRINT OR TYPE

Name of applicant .....

..... STREET ADDRESS ..... CITY ..... ZONE ..... STATE

Date Arriving ..... via ☐ Auto ☐ Plane ☐ Train Date Leaving .....

ACCOMMODATIONS

Hotel ..... FIRST CHOICE

Hotel ..... SECOND CHOICE

Hotel ..... THIRD CHOICE

Hotel ..... FOURTH CHOICE

Hotel ..... FIFTH CHOICE

Hotel ..... SIXTH CHOICE

☐ Single occupancy, rate to range from $..... to $..... per day.

☐ Double occupancy, double bed, rate to range from $..... to $..... per day. } 2 names must be listed below

☐ Double occupancy, twin beds, rate to range from $..... to $..... per day. }

☐ Suite of ..... rooms, including parlor, rate to range from $..... to $..... per day.

Rooms will be occupied by:

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..... NAME ..... ADDRESS ..... CITY ..... STATE

American Society of Dentistry for Children

HIGHLIGHTS OF THE PROGRAM

—Hypnosis in dentistry for children

—Interceptive orthodontics

—Periodontal disease in children

—Changing concepts of dental practice—presented by a panel of excellent speakers who will present both sides of union, welfare and dental service corporation programs.

This will be YOUR national meeting, and it will be our pleasure to make it a success—for YOU. For Saturday evening, we are planning a wonderful President's Banquet, with cocktail party preceding, and dancing to follow, with entertainment in between. It should be THE social event of the entire meeting. We hope you will plan to attend.

Mode R. Perry

General Chairman

Unit News

Student membership . . . read reports from Mendelsohn (Illinois) and Boller (Minnesota). Next deadline date . . . July 25 . . . I'm looking for pictures and news.

Hope you all are making plans to attend the BIG National meeting in sunny Southern California!

TINY KONIKOW

ARIZONA

Ronny Nielsen just made the deadline with this bit of news. The Arizona Unit presented a one-day workshop featuring Dr. H. Bhatia of the School of Dentistry, University of Southern California, Los Angeles, who discussed techniques in pulpal therapy and periodontics. His data in many instances contradicted past studies currently accepted.

The following officers were elected:

President ..... Wm. S. Deeming, Tucson
Vice-President ..... Richard LeSueur, Mesa
Sec.-Treas. ..... Ronald A. Nielsen, Tucson

Dr. Thos. Moore and Dr. Chas. Mehlum of Phoenix will represent the Arizona Unit at the National meeting in Los Angeles in October with a table clinic.

ARKANSAS

O. J. Ratcliff replaces Basil Gibbs as reporter for the Arkansas Unit.

The Arkansas State Dental convention was held April 3, 4, 5 and 6 and was a very successful meeting with the Arkansas Society of Dentistry for Children leading the way with the opening event on Sunday, April 3, with Dr. Joseph T. Hartsook as clinician. His presentations were "First Appointment Procedures for the Pre-School Child" and "Pulpal Problems and Their Management in Primary and Young Dentitions."

The following were elected to serve as officers:

President ..... D. E. Newberry, Osceola
Vice-President ..... Basil W. Gibbs, Star City
Sec.-Treas. ... O. J. Ratcliff, North Little Rock

Plans are being formulated for the Fall Seminar in Hot Springs, details of which will be complete for the next issue of the JOURNAL.

SOUTHERN CALIFORNIA

Lorraine Duncan reports that the meeting held March 28, 1960 at which time guest speaker, Dr. Rulon W. Open-

shaw, presented factual information on "Welfare and Union Dental Programs" was most interesting and informative. The annual business meeting of the Unit was held May 3, 1960 in the Rodger Young Auditorium with Dr. H. Bhatia, assistant professor of the Pedodontic department at U.S.C. School of Dentistry as speaker. His topic was "Periodontal Problems in Children." At this meeting, Life Membership Certificates were presented to four members, each of whom has a record of twenty-five year continuous membership.

Colorado

Once again, Lou Dubin sends a nice bit of reporting. The Colorado Unit held its March meeting at the Denver Athletic Club with cocktails and dinner preceding a very interesting meeting. Dr. Arthur Robinson, a pediatrician, who has gone into research and teaching at the University of Colorado Medical School, was guest speaker. His topic was "The Effects of Irradiation on the Human Cell."

The following officers were elected:

President ..... Jack Eisenson
Vice-President ..... Vincent Kruzick
Secretary-Treasurer ..... Willard Guard

A seminar program is being scheduled for June at one of the mountain resorts. Plans are also going forward for the Academy of Pedodontics meeting in August. Boulder is beautiful at that time of year and Ben Kletsky, Bill Humphrey and Bill Cody are hard at work getting things in order for an interesting and enjoyable meeting.

President Eisenson and wife, Dorothy, are Europe-bound very shortly and Ben Kletsky and his wife will see Europe in September after the Academy meeting.

Connecticut

Nice to hear the news of the Connecticut Unit through Ernest J. Arnow. Here it is!

The Third annual two day Seminar of the Connecticut Society of Dentistry for Children was held during the Spring meeting at the Hotel Statler-Hilton. Dr. Norman Olsen, chairman, department of Pedodontics, Northwestern University Dental School, was the clinician. Control of pain, child management, use of local anesthesia, and injuries to the primary and permanent dentitions were just a few of the interesting topics presented. Dr. Olsen also showed movies on the use of the rubber dam and construction of a space maintainer using a crown and bar with a distal shoe. All who attended the seminar found it stimulating, informative and very well presented.

The following officers were elected:

President ..... Albert J. Sasso, Waterbury
Vice-President ..... James Rubin, Stamford
President-Elect .... Albert Snyder, New Haven
Sec.-Treas. ..... Naomi Dunn, New Britain

On May 21, 1960 a luncheon honoring Dr. Naomi Dunn and Dr. Irving Eichenbaum was held in appreciation of their efforts in making the Society what it is today.

Georgia

From Georgia comes this news from Bill Shupert:

On March 29, the members of the Georgia Unit and their guests attending the annual Hinman Dental Seminar met for luncheon at the Dinkler Hotel in Atlanta. Those present had the privilege of hearing guest speaker, Dr. Melvin A. Noonan of Birmingham, Michigan and Dr. Willard Hunnicutt of Atlanta, swap stories and information about "Frac-

tured Anteriors" and "Practice Management."

On May 5, the Unit sponsored a special presentation on "Migration of Teeth" by Dr. Sheldon Friel of Dublin, Ireland. Members of the Georgia Pediatric Association and dentists in the area were invited to this meeting. Plans are going forward for a Graduate Seminar to be held at the Heart of Atlanta Motel on September 18 and 19, 1960. Dr. Ralph McDonald, chairman of the Department of Pedodontics, University of Indiana, will be guest clinician. The Georgia Unit under the able leadership of its president, Dr. John Wallace and program chairman, Dr. Joe Meadows is rapidly increasing its membership by developing broad interest in the many fine and outstanding programs being currently offered.

Hawaii

Unit Secretary Yokoyama reports that the big news in Hawaii this year is the Pan-Pacific Dental Conference to be held at the Princess Kaiulani Hotel October 22 through 27 in Honolulu. Dental leaders from all parts of the country will participate including, Dr. Chas. H. Patton, Philadelphia, Dr. Harold Hillenbrand, secretary of the ADA; Dr. Maynard K. Hine, Dean of the University of Indiana, School of Dentistry; Colonel Robt. Shira, Army Dental Corps; Dr. Emanuel Cheraskin, University of Alabama; Dr. So Wah Leung, University of Pittsburgh and Dr. Vincent R. Trapozzano of St. Petersburg, Florida. The scientific program will be held on Monday, Tuesday and Wednesday, Oct. 24, 25 and 26. Wednesday night marks the official banquet and entertainment in the Royal Hawaiian Hotel and on Thursday evening, a nine course Chinese dinner will be sponsored at the Waikiki Lau Yee Chai restaurant.

A course on "Advanced Pedodontics" is being planned for December 26 thru 30, 1960 with Dr. I. Irwin Beechen, College of Physicians & Surgeons, San Francisco, and Dr. George Boone, Dept. of Orthodontics, University of Southern California as instructors.

In addition to the above, the Committee on postgraduate study of the Honolulu County Dental Society sponsored a course on "Oral Development and Guidance" on May 29, 30 and 31. Some of the subjects covered were: psychological development, pediatric oral rehabilitation, mechanisms of tooth eruption, the role of nutrition in dental development and development of occlusion. This course was given by Drs. Ralph Steinman, Stanley L. Shephard, David I Asatani, Jack K. Zwemer, and Thos. J. Zwemer, of the School of Dentistry, College of Medical Evangelists, Loma Linda, California.

Idaho

Wes Young reports that the Pacific Northwest is literally swamped with meetings this year. From all indications the Idaho Unit will have two outstanding pedodontic sessions. The registration for the joint meeting of the Montana and Idaho Societies is progressing and when the Yellowstone Park meeting is over, the Unit has planned the second big attraction for members—the Pacific Coast Conference on Dentistry for Children to be held at Shore Lodge on beautiful Payette Lakes (McCall) Idaho in August. Rooms are limited, but an early request to Dr. Franklin Hyke, 330 Fifth St., Lewiston, Idaho *might* get you in.

Florida

"No astounding bits of news this issue," says Neil Powell from the "Sunshine" State. The Florida Unit held a very fine meeting on May 14, 15, 1960 at Miami Beach with Dr. Joseph Muhler from the University of Indiana as guest clinician. Dr. Albert Anderson, California, also participated in the program.

Illinois

The Annual Spring Seminar of the Illinois Unit was held April 4, 5, 6 at the Wagon Wheel Lodge in Rockton, Ill. Tiny Konikow, president of the Michigan Society of Dentistry for Children and News Editor of the Journal, conducted sessions on "Controlling Pedodontic Problems" and "Preoperative Sedation and Tranquilization." He covered many new areas in the psychologic and psychopharmacologic management of children emphasizing successful treatment for behavior disorders, handicapped and difficult children. Clinical, technical and psychologic aids were illustrated and described.

Left to right: Bill Sowle, president; Bob Way, program chairman; Jane Selbe, president-elect; and speaker, Tiny Konikow.

Members of Illinois Unit, left to right: Harold Brandlein, Jane Selbe, Al Altman, Tiny Konikow (clinician), Ron Rothenberg, Asher Sherow, Paul Brown, Bob Way, Bill Sowle.

Tom Barber, associate professor of pedodontics at the University of Illinois, told of the current research being conducted in his department. He attacked some persistent and oft repeated concepts as erroneous and nonfactual. Especially illuminating were his discussions of the lateral oblique and conventional lateral headplates, and the path of the erupting tooth through bone. The Unit is most appreciative to Chairman Robert Way and Harold Brandlein for an excellent seminar.

The Illinois Unit is presently engaged upon a vigorous effort to familiarize the students of the three local dental schools with ASDC and student member affiliation. Two Society members will visit each school, speaking to the third and fourth year classes; printed material will be distributed.

Further efforts and accomplishments in student interest is or should be one of the most important functions of the Society.

Regarding news of schools . . . M. Massler, head of the department of pedodontics of the University of Illinois, is in

Israel with the School of Dentistry for six months on a Fulbright grant. He is setting up a Pedodontic department, lecturing at the School and to the Israel Dental Association. Plans are progressing at Northwestern for the annual Pedodontics teachers conference June 6, 7 and 8.

Iowa

Just a short report from R. B. Hufford who relinquishes the job of reporting the news to Duane Schmidt.

The annual meeting in April was a very successful and enjoyable one which featured Dr. Ralph McDonald, vice-president of the American Society of Dentistry for Children and chairman of the Department of Pedodontics at the University of Indiana as the guest speaker.

New officers for the year are:

President	A. Miles Olson
Vice-President	R. B. Hufford
President-Elect	W. G. Yeager
Secretary-Treasurer	Duane Schmidt

Michigan

Joe Engelman reports that on Wednesday, May 5, 1960 the Unit met for luncheon in the Ivory Room of the Statler Hotel. A short business meeting followed with election of the following officers:

President	"Tiny" Konikow (Re-elected)
Vice-President	Richard Christl
Secretary-Treasurer	Walter Niemann

Hugh Kopel introduced Dr. Laren W. Teutsch of Omaha as the guest speaker. Dr. Teutsch presented some very fine slides of his office design and stressed that the three important things in selecting an office were: Location, Location, *Location*. Secretary Niemann in his report stated that the co-sponsorship approach (the Michigan Unit and District Dental Society) had brought about better programs and greater attendance at meetings. Bill Brown, president of ASDC, reported that the California Unit is "buzzing" with great plans for the National meeting.

Minnesota

An all day seminar was held on March 24 with Dr. Mel Noonan from Birmingham, Michigan as guest speaker. Mel spoke on "Fractured Anteriors" in the forenoon and his topic for the afternon session was "Practice Management." As usual he did a great job and even found time to squeeze in a story or two!

The annual dinner and social meeting was held in May with an invitation extended to all the wives to attend. A short business meeting and election of officers preceded George Grim, well-known newspaper man and traveler who spoke on "Current Events in the News."

Plans are already underway for the BIG annual all day meeting which will be devoted to Preventive Orthodontics. The meeting will be held at Mayo Memorial Auditorium Thursday, September 24, 1960 with Dr. Earl Shepherd of St. Louis, Missouri as guest speaker. All Minnesota men are urged to mark this date on their appointment books now.

Missouri

From John Durham comes this news: The Missouri Unit had as their guest speaker at the February 2, 1960 meeting, Dr. Jos. T. Hartsook of the University of Michigan who spoke on "Clinical Dentistry for Children." This meeting was held jointly with the St. Louis Dental Society and was very well attended. On April 12, a program designed for senior students at St. Louis University and Washington University was held.

The Unit attended as a group on May 25, 1960 when Dr. Wm. Humphrey of Denver addressed the Missouri State Dental Association meeting in St. Louis.

Officers for the year are:

President ..... Quentin M. Ringenberg
Vice-President ..... Edward G. Brungard
Secretary-Treasurer ..... Leo S. Shanley
Corresponding Secretary .... John G. Durham

The Missouri Specialty law came into effect on January 1, 1960 and 22 pedodontists have now been certified. Drs. John Clayton and Jack Gilster will serve on the Certification Board for Pedodontics and Dr. Earl Bean has been named to the Orthodontic Certification Board.

Other highlights of the Unit included clinicing by Dr. Earl Shepherd who presented a paper on "Interceptive Orthodontics" at the Chicago Mid-Winter meeting and Roy Wolff who presented three clinics at the Chicago meeting.

Jack Gilster and Neal Newton appeared on KETC television on February 3, 1960 on a half hour program entitled "Parent Education in Pedodontics." This program which stressed home care and diet control was in observance of National Children's Dental Health Week.

Of interest is this bit of news . . . Dr. Ruth Martin is well and happy and now living at 126 W. Calle Crespis, Santa Barbara, Calif. She would enjoy hearing from some of you.

Montana

The Montana Unit is planning its largest meeting, to be held with the Idaho Unit and "members at large" from Wyoming, in June at Yellowstone National Park. Dr. Bernard Rabinowitch of Beverly Hills, California will be the guest speaker. Fred Schwin reports the total membership is 76 which is 11 more members than last year. Much of the credit for the increase is due the fine membership committee organized by President Len Hall. Dr. Bundy of Miles City has also done a good job on the membership commitee in his area of the State.

New York

Ovid Slavin, new reporter for the New York Unit writes: The New York State Society of Dentistry for Children had its annual meeting on April 2 and 3, at the Sheraton Hotel in Buffalo. It was by far the best, and the best attended.

Dr. Robert E. Moyers of the University of Michigan was the essayist on April 2. More than 200 attended. On the following day, Dr. Wilton M. Krogman, director of the Philadelphia Center for Research in Child Growth was the essayist.

The following officers were installed:

President ..... Roland Hawes, Rochester
President-Elect .... Chas. F. Beck, Tarrytown
Vice-President .... Walter R. Woods, Syracuse
Sec.-Treas. .... Ovid Slavin, New Hyde Park

Membership total has passed the 600 mark and is still growing. The mid-year meeting in October will be held at Utica, N. Y.

North Carolina

On April 7, 1960, the North Carolina Unit held its First Annual Spring Seminar at Chapel Hill. The featured speaker of the day was Dr. William E. Brown from the University of Michigan, School of Dentistry and President of the American Society of Dentistry for Children. His topics for discussion were "Preventive Orthodontics" and "Practice Management." Members of the Demeritt Study Club presented a series of table clinics

in the afternoon following Dr. Brown's presentation. The Unit would like to commend Dr. Brown and the members of the Study Club for their outstanding presentations.

Several South Carolina dentists who are members of the American Society of Dentistry for Children were invited to attend the Seminar with the purpose of discussing the possibility of forming a Unit in South Carolina. These dentists met with Dr. Brown who discussed with them the policies for the formation of a new unit. We would like to encourage all dentists in South Carolina who are interested in forming a unit to contact Dr. Charles Barnett, Greenville, S. C. The North Carolina Unit has offered its assistance in the formation of a group, in its "sister State." During the business meeting it was decided to hold elections in the Fall of each year during our Annual Seminar. As a result of this action the new officers for the ensuing year were not nominated or elected.

The Second Annual Two Day Seminar will be held in Raleigh, N. C. next year, and we are looking forward to another outstanding meeting.

Ohio

W. C. Schweller of the Dayton section of the Ohio Unit reports that the quarterly meeting was held on Feb. 16 at the Van Cleve Hotel. Dr. Pettit and Dr. Gillig discussed diseases of the soft tissues in children. Dr. Pettit noted that the slowing of the blood stream at the interdental papillae was a basic reason for gingivitis.

Members of the Unit presented table clinics at the all day meeting of the Dayton Dental Society. Several cases of replanted teeth were shown.

Puerto Rico

Molly George sends the news of the newly chartered Puerto Rico Unit. During the Puerto Rico Dental convention in January, the Unit had an exhibit of models displaying treatment for traumatized incisors and types of cavity preparations for the primary dentition. A television program featured Dr. Carmen Nolla who spoke on "The Treatment of Traumatized Incisor Teeth." Dr. Nolla spent the week of February 21 through 27 in Bogota, Colombia, attending the first Pan American Congress on Dentistry for Children. The Congress was held at the National University of Colombia with 32 delegates from twelve different countries in attendance. It was most successful and the Colombian Society is to be congratulated for the fine way it was conducted. The Puerto Rico Unit is sending a reproduction of the Seal of Puerto Rico to the Colombian Society in commemoration of the first Congress.

Dr. Iraida (Ricky) Pinero attended the Annual meeting of the International Association of Dental Research in March and presented a very interesting paper. Drs. Molly George and Harvey Emmerson attended the International Association of Dental Research and the A.A.D.S. meetings in Chicago recently.

Rhode Island

From Dick Whelan comes this news of his Unit. The Rhode Island Unit has had two excellent clinicians in the persons of Dr. Z. "Tiny" Konikow of Royal Oak, Michigan and Dr. John B. MacDonald of Boston. Dr. Konikow presented a very informative clinic on "Pedodontic Practice Management" illustrated with kodachrome slides. He presented his

techniques of educating the child and parent and methods of behavior control. Dr. MacDonald lectured on "Bacterial Problems in Children's Dentistry" which was very interesting and well received. At the Annual meeting in May, two outstanding pedodontists were lecturers. Dr. Harold K. Addleston had as his topic "Safety in Dental X-ray Technique" and Dr. Sidney Kronfeld discussed "Pulp Care and Pulpotomy."

Virginia

The Virginia Society of Dentistry for Children held its tenth anniversary meeting on April 24, 1960 at the Hotel John Marshall in Richmond. The scientific and business meetings were preceded by a social hour and banquet. The Virginia Component was chartered in October, 1950, and its first regularly elected officers were installed in 1951. In recognition of their contribution to the Society, all past presidents received service plaques. Dr. G. A. C. "Skeeter" Jennings, the first president, made a brief talk on behalf of the past presidents who were present. Those receiving awards in addition to Dr. Jennings were Drs. C. K. Garrard, J. R. Lewis, L. H. Blevins, T. C. Bradshaw, T. E. Skeppstrom, M. D. Largent and J. L. Lilly. Dr. Bernard A. Brann, president-elect, presented the service award to out-going president Luke Pillis.

Dr. Douglas J. Sanders, chairman of the Department of Pedodontics, University of Maryland, was speaker at the anniversary meeting and presented a most interesting talk on what to look for in diagnosing a child's mouth. The requests for copies of "Sugar and Dental Caries" folders which have been mentioned before have been rolling in. As a result, the Society voted to have a third printing which will be available shortly.

The Virginia Component usually has one meeting a year since the membership is scattered over the state. However, it was voted to have a second meeting in the Fall in connection with the Medical College of Virginia postgraduate course in pedodontics.

Officers for the coming year are:

President	Bernard A. Brann
President-Elect	R. Paul Fultz, Jr.
Vice-President	Leon Slavin
Secretary-Treasurer	Chas. J. Vincent

Washington

With David B. Mooers, new reporter, we can see that the Washington Unit is off to a flying start. The annual business meeting was held on March 20 with the following men elected to serve as officers for 1960:

President	Neil Beasley, Seattle
Vice-President	Rolland Woofter, Kennewick
Sec.-Treas.	Robert Morrow, Opportunity

The Washington Unit is looking forward to an informative Spring-Summer session at Yakima on June 19, 1960 with Dr. Claude Warden of California as clinician.

Robert Morrow looking on as Past-President Cordon of Spokane receives a plaque of appreciation from Neil Beasley for an outstanding job as president during the past year.

Pan American Council of Dentistry For Children

Here is the report on the first Pan American Congress of Dentistry for Children as reported by Antonio Montero.

During the week of February 21-27, 1960, the city of Bogota, Colombia, was the site of the First Pan American Congress of Dentistry for Children and the Third meeting of the Pan American Council of Dentistry for Children. Both events were held at the Faculty of Dentistry of the National University. The meeting was held under the auspices of the Pan American Council and its affiliate, the Colombian Society of Dentistry for Children, which arranged a splendid scientific and social program that lasted through a week of lectures, table clinics, movies, closed circuit TV demonstrations, etc. The program included prominent lecturers, such as Drs. McBride, Cheraskin, Hitchcock, Finn, Fass, Harris and Anderson from the United States, as well as many others from Latin America. A large attendance of delegates from Argentina, Brazil, Cuba, Colombia, Ecuador, El Salvador, Guatemala, Haiti, Mexico, Bolivia, United States, Peru, Venezuela, Panama and Puerto Rico made possible a most stimulating exchange of ideas, knowledge and good will, working towards the advancement of dentistry for children.

A gesture worth mentioning is that the generous financial support from the Colombian government made possible the adaptation of the conference room of the Dental School for simultaneous translation into Spanish, English and Portuguese. After the meetings, all the installations and equipment were donated to the Faculty by the Colombian Society of Dentistry for Children.

At the Third meeting of the Pan American Congress, many important motions and future activities were discussed, among them the celebration of a Pan American Children's Dental Health Week, and an association with the Pan American Union and OAS. Other motions were the promotion of water fluoridation, the exchange of dental education material between dental schools and societies of affiliate countries.

The Council meets every two years,

The Executive Directors of the Pan American Council in session at its convocation in Bogota, Colombia. Left to right: Antonio Montero (Cuba) secretary; Maria I. Navarra (Uraguay) vice-president; Benjamin Gomez (Colombia) president; Albert L. Anderson (United States) president-elect; Samuel D. Harris (United States) founder.

BOGOTA, COLOMBIA, SOUTH AMERICA—FEBRUARY 21-28, 1960
American Dental Association participants at the Third Pan American Council and the First Pan American Congress of Dentistry for Children. Front row—left to right: H. Perry Hitchcock, Elias Fass, E. Cheraskin, Sidney B. Finn, Walter McBride, Samuel D. Harris, Albert Anderson.

and it was agreed to hold a Congress coinciding with each meeting.

Election of new officers for 1960-62 was held, the following being elected:

President .... Albert Anderson, United States
President-Elect ... Maria L. Navarra, Uruguay
Vice-President .... E. Garcia Salas, Guatemala
Secretary ..... Antonio Montero, Cuba
Treasurer ..... Estudardo Pazmino, Ecuador

Those interested in obtaining further information about the PAC and its activities may write to the Secretary, Antonio Montero, L No. 353, Vedado, Habana, Cuba.

ADDENDA

The following is a verbatim report by Walter McBride on observations made of the Pan American Congress.

"I was at Bogota. I was one of the privileged few who attended the First Pan American Congress of Dentistry for Children held in that city the week of February 21, 1960. Bogota is bursting at its seams with new developments and building programs. It is a city of well over a million people so situated that it is the economic hub of Colombia and the northwestern portion of South America. Weatherwise, it was delightful and cool . . . 62 to 70 degrees. Though being close to the equator it is over 8,000 feet above sea level which sums up to something similar to San Francisco weather —minus the fog. The hospitality of Latin America is both gallant and exhausting. Cocktail hours were scheduled

at the end of each day's program, or let's say at the beginning of the round of entertainment provided for each night of the week! Dinner was served not earlier than nine and in some cases as late as ten or eleven. But, everyone was up and away for the eight o'clock sessions held at the distant University Dental School. The big event socially was the bull fight on Sunday, at which, incidentally, Adlai Stevenson was a much lionized guest. An event of slightly less gayety was the afternoon picnic and lunch held at the six hundred year old salt mines some thirty miles outside of Bogota. Also, the guests were entertained at a cocktail hour and inspection tour of the neighboring Javeriana University Dental School. The host was the Colombian Society of Dentistry for Children, with Dr. Benjamin Gomez as chairman. The sessions were held in the Colombian National University Dental School with the Colombian Tourist Association supporting the enterprise to the sum of $10,000. One of the classrooms in the University had been rehabilitated with theatre seating arrangements, curtained especially for kodachrome projection and equipped with ear phones at each seat. Three linguists were stationed in a special booth who rotated the translations from English to Spanish, Portuguese to Spanish and Spanish to English. Those speaking or understanding English only were able to participate in all the programs except those presented by Brazilians who speak Portuguese. All Latin America speaks Spanish except the Brazilians. There were speakers from Colombia, Chile, Paraguay, Uruguay, Brazil, Argentina and six guests from the U. S. Those on the programs from our country were, Drs. Fass, New York City; Anderson, Los Angeles; Hitchcock, Finn and Cheraskin from the University of Alabama and Harris and McBride from Detroit. The next Pan American Congress will be held in Guatemala in 1962."

Announcements

The American Board of Hypnosis in Dentistry will meet October 5, 1960 at the Willard Hotel, Washington, D. C.

Applicants for certification who wish to appear for examination at that time should please communicate with the secretary, Dr. S. Irwin Shaw, 18201 Cherrylawn Avenue, Detroit 21, Michigan, prior to September 1, 1960.

* * *

Fifth Annual Pedodontic Seminar

Northern California Unit—A.S.D.C.

Thursday to Sunday, September 15-18, 1960
Squaw Valley, California

THEME: "PRACTICAL DENTISTRY"

Locale: Nature's Wonderland

This year we have chosen beautiful Squaw Valley in the majestic Sierra Nevadas, home of the VIII Winter Olympics, as the site of our Seminar. The atmosphere will be as casual as the rugged Sierras, so bring your jeans and hiking boots.

Program

At the members' request, we have chosen three half days of Practical Dentistry.

"General Anesthesia and Operative Dentistry"

Speaker—John Tocchini, D.D.S.

"Practical Pharmacology" for use in the office

Speaker—Donald Zimmerman, D.D.S.

"Interceptive Orthodontics"

Distinguished Panel on "Tooth Guidance and Space Maintenance"

Recreation

The program has been arranged to allow maximum enjoyment of scenic Squaw Valley. Attractions include sight seeing, hiking, horseback riding, swimming, tennis, ice skating in Blythe Arena, boating, the annual men's and women's golf tournament and try your luck at our Calcutta. Special Friday night banquet at fabulous North Shore Club, with the evening free to try your "luck" or relax.

For the women—luncheon at the top of the world's highest ski lift.

Meeting Information

The fee includes Thursday night lodging and Friday and Saturday's lodging and meals, September 15 through September 17. Wives are cordially invited.

Members	$ 65.00
Members and wives	110.00

Reservations and deluxe accommodations are limited and will be on a first-come first-served basis. Don't be disappointed, send your check in now. The deadline is July 1. If you wish you may accompany your application with one half the total fee and send the balance by July 1, 1960. There will be no refunds after that date. Applicants must be members of A.S.D.C. Send your check to Bob Burley, 1402 Maria Lane, Walnut Creek, California.

Material intended for Unit News should be sent to Tiny Konikow, 500 S. Washington Ave., Royal Oak, Michigan. Deadline dates are: First Quarter, January 25; Second Quarter, April 25; Third Quarter, July 25; Fourth Quarter, October 25.

CONFERENCE OF NATIONAL ORGANIZATIONS FOR AREAS OF DENTAL PRACTICE

The American Society of Dentistry for Children was represented by President William E. Brown, President-Elect James H. Simmons and Vice President Ralph E. McDonald at the Conference of National Organizations for Areas of Dental Practice which was held on June 2-3, 1960 at the Drake Hotel, Chicago.

There were present 43 groups at this conference, as representatives of participating and observing organizations. The conference was sponsored by the American Dental Association under the direction of the Board of Trustees with Doctor John S. Eilar, 12th District Trustee, presiding.

The purpose of the conference was to discuss common problems in the establishment, administration, program and growth of national organizations interested in areas of dental practice.

Mr. Bernard J. Conway, assistant secretary for legal affairs, reported that at the most recent meeting of the Judicial Council, there was a prepared amendment to Section 18 of the Principles of Ethics to spell out the dentist's right to announce in areas of dental practice. This will be presented to the House of Delegates of the A.D.A. at the 1960 annual session.

Doctor Harold Hillenbrand, Secretary of the A.D.A., reported the following: (1) There is no permanent policy established in the A.D.A. By-laws for the affiliation of any groups except the constituents and component societies. (2) The Association encourages the establishment of groups to advance given areas of dental practice. (3) The Association believes that such groups have value in providing continuing education for the dentist in given areas of dental practice.

Special references to the A.S.D.C. are as follows: (1) Mr. Peter C. Goulding, director, Bureau of Public Information, pointed out as an example of cooperation that the A.D.A. and A.S.D.C. were working together on a special closed-circuit television program for the 1961 annual session in Philadelphia. (2) Mr. Perry J. Sandell, director, Bureau of Dental Health Education, noted the cooperation with A.S.D.C. in the release of "Pointers for Parents" and also the use of the A.S.D.C. mailing list for items of interest to the membership. (3) Doctor Lon Morrey, Editor, American Dental Association noted that the A.S.D.C. has been very active in the American Society of Dental Editors through Doctor Al Seyler, Editor of the JOURNAL OF DENTISTRY FOR CHILDREN.

Your committee was of the opinion that through the cooperation and activities of the American Board of Pedodontics, the American Academy of Pedodontics, and the American Society of Dentistry for Children and its Journal, the area of Dentistry for Children and the opportunity for continuing education in this field is being given maximum emphasis.

JAMES H. SIMMONS

Topical Stannous Fluoride in a Pedodontic Practice

RAYMOND E. ROTHHAAR, D.D.S.

PREVIOUS studies by the Indiana group,[1-5] by Jordan in Minnesota,[6] and by Compton, Burgess, Mondraw, Grainger and Nikiforuk in Canada[7] have shown the effectiveness of stannous fluoride using the single application technique. In all of these studies, critical experimental conditions pertaining to test design and experimental control subjects were used. No study reported thus far has evaluated the effectiveness of the single stannous fluoride application technique as would be used in the office of the general practitioner or pedodontist. This present study was performed for this reason, and gives the results of the semi-annual re-application of a single application of stannous fluoride during a 3 year study period.

EXPERIMENTAL

Approximately 350 children, ranging in age from 3 to 15 years, were selected at random from patients comprising a practice limited to pedodontics in Muncie, Indiana. The fluoride content of the communal water supply during the first 30 months of the study varied from 0.01 to 0.018 ppm. During the last six months Muncie fluoridated their water and the fluoride content was increased to 1.0 ppm. Initially, each child received a single topical application of an 8 per cent solution of stannous fluoride according to the technique described by Muhler,[8] and each six months thereafter for a 3 year period. In addition to the topical stannous fluoride applications the children received the normal restorative dentistry as would have been provided for them even though the topical program was not being evaluated. No particular attention was given to any child in regard to dental education in the study program which normally would not have been provided for him. No control group was used. Furthermore, the design of the study was to determine what effect the single topical application would have on the burden of a pedodontic practice, with particular respect to the restorative aspects of the practice.

DATA AND DISCUSSION

The data obtained in this study are shown in table 1. The table is divided into three groups on the basis of an arbitrary division according to the subjects which were caries-free following topical stannous fluoride therapy at the end of either 18 or 36 months. Group I, for example, is comprised of 129 patients who at the initial examination had 1,378 decayed, missing or restored surfaces; Group II is comprised of 66 patients who had a total of 905 DMF surfaces; and, Group III, 127 patients with a total of 2,034 DMF surfaces. In essence, however, these groups represented three classes of children with different orders of caries susceptibility. In Group I the mean initial caries susceptibility in terms of DMF surfaces was 10.68, Group II children 13.70, and those in Group III 15.80. While it is not accurate to state that the children in Group I had a low susceptibility, it is obvious that they were lower than those in Group III. This division is also of interest since there is clinical evidence to support the belief that a child with a low susceptibility can be treated with a practical preventive dentistry program[9] which includes good operative dentistry, practical advice on nutrition,

TABLE 1

THE EFFECT OF THE SINGLE APPLICATION OF SnF_2 ON DENTAL CARIES IN CHILDREN FROM A PRACTICE LIMITED TO PEDODONTICS

Group	*No. of Patients*	*Original No. of Surfaces*	*Mean Initial Caries Experience*	*New Surfaces After 18 Months*	*New Surfaces After 36 Months*
I	129	1378	10.68	0	0
II	66	905	13.70	227	0
III	127	2034	15.80	196	551

good oral hygiene using a stannous fluoride dentifrice, and topical stannous fluoride therapy in such a manner as to almost completely eliminate new caries. Certainly the data obtained in this study support this, since 129 children had no new carious surfaces after the series of stannous fluoride treatments when re-evaluated at either 18 or 36 months. The children in Group II, those with a slightly higher susceptibility than the children in Group I, had a total of 227 new surfaces after receiving 3 separate stannous fluoride topicals at 6-month intervals, but no new surfaces after 3 years (or 6 separate treatments). This suggests that repeated re-applications are of considerable benefit in further reducing the subsequent caries attack rate. The group with the highest initial caries attack rate (Group III) benefited materially from the topical therapy, since after 3 years (six separate treatments at 6 month intervals) there were only 551 new surfaces.

Of course it is not possible, without appropriate controls, to determine what the over-all reduction is in such a study program, but it is possible to show that when the single topical application technique is used in a pedodontic practice that the control of dental caries is quite within the reach of each dentist. Even in the case when there is a fairly high susceptibility (Group III), the caries experience can be materially reduced. If one would consider the caries increment in the Group III children in respect to the over-all state of Indiana caries experiences (3.0 new surfaces per child per year) in only those children living in a non-fluoride area, this study would show that if the normal expected caries rate would have prevailed in this study one would expect a total prevalence of approximately 1,200 new surfaces in the 127 children at the end of 3 years. In this study, however, only 551 new surfaces resulted after 3 years, and such a comparison would indicate a reduction of about 60 per cent. This figure corresponds well with studies performed by Mercer[10] in which he compared 1 and 2 applications of stannous fluoride with 1 application of sodium fluoride.

This study demonstrates the marked anticariogenic effectiveness of the single stannous fluoride application technique when used under those conditions usually provided in a pedodontist's office and practice. One must, of course, not limit their preventive services to only topical stannous fluoride therapy, but should use as many preventive tools as possible in order to decrease and ultimately stop the caries attack in our practices. It does seem, however, that caries control is made much more within our grasp with the frequent re-application of topical stannous fluoride.

Conclusion

The topical application of stannous fluoride using the single application procedure was evaluated as an anticariogenic technique in a private practice limited to pedodontics. All of the children received a series of six applications spaced six months apart. The results indicated that one group of 129 children had no new caries after an 18 or 36 month period. A second group of 66 children had 227 new surfaces after 3 re-applications but no new caries after 3 more re-applications. The third group of 127 children had a total of 551 new surfaces after 6 re-applications. These data demonstrated the anticariogenic effect of stannous fluoride when re-applied each six months under the practical conditions as exist in a practice limited to pedodontics.

461 Johnson Bldg.
Muncie, Indiana

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Psychopathologic Thumbsucking—A Case Report

WOODROW S. MONICA, D.M.D.

SUCKING is an instinct of self-preservation in infants.[1] Gratification of this instinct strengthens the oral drive to suck and frequently leads to persistent thumbsucking. This non-nutritional habit is common in healthy and happy infants; it seems to ease tensions and afford pleasures to them.[2] The habit disappears usually by the fifth year, but if it persists beyond that time, the habit becomes psychopathologic.[3]

The following case report suggests psychopathologic thumbsucking in an adolescent.

CASE REPORT

A 14 year old boy sucked his left thumb since infancy, sucking at bedtime and during inactive periods at home. Detailed records of his infant feeding habits, toilet training and interpersonal adjustments were unavailable. His father tried to discourage the habit without threatening the boy. The patient was physically well-developed, quiet and cooperative in the dental chair. He was a fair student; liked sports and played well with other boys.

In a playground accident in June 1959, he suffered a concave fracture of the incisal edge of the left upper central incisor (Fig. 1). The fractured tooth was jagged and extremely sharp at the mesial and distal incisal angles. The evening of the accident he stopped sucking his thumb because "the tooth was too sharp." Six months after the accident, he was "glad" that he didn't suck his thumb any more and he seemed emotionally adjusted to the new experience.

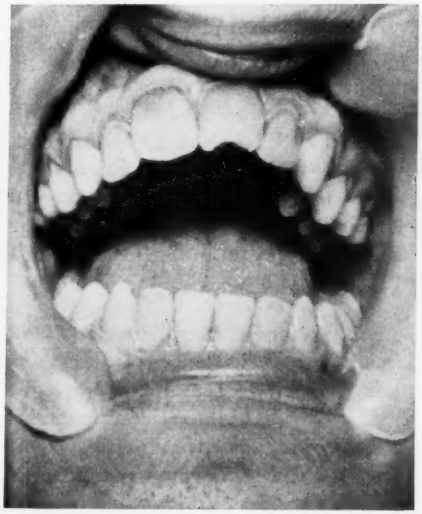

FIGURE 1. Concave Fracture of the Incisal Edge.

COMMENT

The boy never overcame an infant desire to suck his thumb for reasons that I am not qualified to conjecture upon. However, he developed a deeply ingrained habit of sucking only his left thumb. The urge to suck was more than oral gratification because after the accident he did not direct his oral drive to the right thumb nor to any finger. Furthermore, he was "glad" that he stopped the infantile habit. He considered the jagged tooth an accident and not a premeditated restraint on his thumbsucking. He willingly assented to not having the tooth polished.

310 Main Street
Orange, N. J.

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Retrolental Fibroplasia With Hypoplasia Of the Primary Teeth

MORRIS KELNER, D.D.S.

INTRODUCTION

RETROLENTAL FIBROPLASIA, or R. L. F., is an ocular condition which occurs primarily in premature infants with an extremely small birth weight. It was first described by Terry[1] in 1942, and until 1955 ranked as a major cause of blindness in children. The clinical picture is that of a small, sightless, staring eye with a fixed, ragged white pupil. The orbital contents do not grow, so that the bulb is depressed and the lids droop to give a false ptosis. The basic pathology of R. L. F. is a proliferation of the endothelial cells of the peripheral retinal capillaries. The advance or regression of this disease is a consequence of continued proliferation. The presence of a large mass of tissue behind the lens is the most striking phenomenon of the fully developed case. R. F. L. occurs in about 10 per cent of the prematures of three pounds or less. Of these, 30 per cent become afflicted with the final or cicatricial phase of the disease.

REVIEW OF THE LITERATURE

In 1951, the Conference on Retrolental Fibroplasia[2] summarized its discussions as follows:

"1. Retrolental Fibroplasia is a definite clinical entity. It is distinct from any type of disease which may produce an end picture of disorganization of the retina.

2. The eyes are normal at birth.

3. The etiologic agent is unknown, nor is it known whether the disease results from prenatal or postnatal causes.

4. No effective therapeutic agent is known. In light of the high mortality rate in prematures of extremely small weight, and noting a greater percentage of children with R. L. F. in mental institutions as compared to a corresponding number of sighted prematures of the same age group, the conference felt that systemic disease could be a factor."

The conference reconvened in 1953.[3] During the intervening years, numerous research projects suggested that the cause of R. L. F. was the lengthy administration of high concentrations of oxygen at birth. This was thought to cause a proliferation of the peripheral retinal vessels, resulting in neo-vascularization, retinal detachment, and formation of a membrane behind the lens.

In 1957, the American Academy of Pediatrics[4] reported "The accumulated evidence definitely incriminates the excessive use of supplemental oxygen as a major factor in the cause of Retrolental Fibroplasia in premature infants. Excessive use implies concentrations of more than 40 per cent or the prolongation of administration."

CASE HISTORY

A 4 year and 5 month old boy, with binocular cicatricial Retrolental Fibroplasia, born prematurely in November 1953, was referred for treatment. The medical history of both parents was unrevealing. They have a daughter, 18 years older than her brother, born at

term, weighing 6 pounds and 10 ounces. She had a negative medical history and did not have any developmental or unusual problems in either her primary or permanent teeth. There were two miscarriages, each at about 4 months gestation, between the births of the two children. The prenatal history was replete with severe emotional stresses complicated by the possibility of miscarriage. The child was born after 6½ months gestation and weighed 2 pounds and 7 ounces. Upon delivery, he was placed in an isolete, and was given oxygen for *65 days*. He was discharged from the hospital at 2½ months, weighing about 5½ pounds, apparently in good health. At 4 months, the pediatrician became concerned about the child's eyes. An ophthalmologist was consulted, and a diagnosis of cicatricial Retrolental Fibroplasia was established at 4½ months of age.

Other than the R. L. F., the child has been well. He was of normal intelligence, and despite his handicap, was neither sullen, frustrated nor introversive. Because of pre-occupation with the ocular problem, the child's dental needs were never considered. The mother became aware of the dental problem only after "the front teeth seemed to fall to pieces." There was no history of previous or present pain or swelling.

Clinically, the mouth presented the twenty primary teeth, in normal occlusal but closed bite relationship. The crowns of all the posterior teeth, except the upper left first molar, were hypoplastic and almost completely destroyed by dental caries. The upper left first molar presented hypoplastic lesions with early carious lesions on the buccal and occlusal surfaces. The maxillary anterior teeth, except the left cuspid, were hypoplastic with advanced dental caries on all their surfaces. The left cuspid was unaffected. The only area of involvement of the mandibular anterior teeth was on the labial and distal surfaces of the right cuspid. There was no evidence of healed or discharging fistulae. The gingiva, hard and soft palates, tongue, floor of the mouth, and buccal mucosa appeared essentially normal.

The roentgenographs revealed carious involvement of the pulps of all the seriously affected teeth. There was no periapical, intra-radicular, or other interosseous pathology. The apparent normal calcification of the successor teeth was discernible.

The mouth was restored to a healthy and well functioning condition. The involved pulps were either capped or pulpotomized, depending upon the origin and size of the exposure. Stainless steel crowns were used to restore the badly broken down teeth. Labial windows were created in the maxillary anterior crowns. The minor areas of involvement were restored with amalgam.

Massler[5] has written "Decay often attacks the hypoplastic defects on the cervical areas of the anterior teeth, ascending towards the incisal edge, and hypoplastic areas on the buccal and lingual surfaces of the molar teeth, descending towards the cervical areas. This pattern of caries progress is almost unknown in non-hypoplastic teeth." The degree of destruction in this child's mouth precluded proper chronologic categorization of the hypoplasia. However, the approximate locale of the hypoplastic areas, as adjudged by the residual areas of intact enamel remaining on some of the teeth, suggested the hypoplasia may have occurred between the 6th and 7th gestational month. The only tooth available for critical evaluation was the upper left first molar, with hypoplastic areas

on the occlusal surface and on the inferior border of the middle third of the buccal surface. If this tooth was a true index of the entire primary dentition, we could assume the hypoplasia occurred at the 6th or 7th gestational month. However, we are merely hypothesizing, since both approaches to categorization are on too narrow a base. Since this child was born after 6½ months gestation, the inferred identification of late prenatal hypoplasia could also be classified as *neonatal hypoplasia associated with prematurity.*

Discussion

Since we are reporting on a case of hypoplasia of the primary teeth in a child with cicatricial R. L. F., the literature was searched to uncover a possible relationship between R. L. F. and other systemic diseases which might be a factor in causing the hypoplasia. The *only* reference to hypoplasia of the primary teeth in premature children who had developed R. L. F. was by Forrester and Miller[6] in 1955. They reported a 16 per cent incidence in 62 children examined. This compares with 5.7 per cent in normal children.[5, 7]

Hirose and Yoshika,[8] in 1956, reported examining 15 anencephalic fetuses. They found 3 of the 30 eyes presented the classical picture of cicatricial R. L. F. This led the authors to postulate the disease may be of congenital or prenatal origin. In 1958, Crome[9] reported on R. L. F. and its association with Neural and Somatic diseases. He wrote, "It is suggested that Retrolental Fibroplasia is not only an ocular condition, but may often be a local manifestation of a more general disorder or group of disorders." In 1958, Parmalee[10] reported that of 38 children blind as a result of R. L. F., 32 per cent were considered mentally retarded.

Summary

The pathology and clinical picture of Retrolental Fibroplasia have been discussed. A case of a child, blinded by bilateral cicatricial Retrolental Fibroplasia, with hypoplasia of the primary teeth has been discussed. Categorization of the hypoplasia suggested a classification of neonatal hypoplasia associated with prematurity.

Conclusions

The conflict between the hypotheses of the original researchers and the recent references to the disease, embellished by the paucity of information on dental findings in children with this disease, demonstrates a need for further investigation and reporting of the dental phenomena in children with Retrolental Fibroplasia.

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Abstracts

EXPANSION OF THE MIDPALATAL SUTURE, STUDIED BY MEANS OF METALLIC IMPLANTS—Aage Krebs, Acta Odontologica Scandinavica: Vol. 17, No. 4, P. 491-501, Dec. 1959.

This provocative article should be of interest to both the pedodontist and the orthodontist. More and more is being learned about European techniques associated with expansion of the maxilla and mandible.

Dr. Krebs demonstrates in this article that through the use of vitallium implants placed in strategic areas of the maxilla, definite expansion is created by use of the removable screw appliance. In the preliminary work reported, there was an increase of width about twice that of the basal maxillary segments, while the increase of the alveolar arch lingual to the canines was almost midway between these two.

Cephalograms showed great accuracy in the determination of the increase in distance between the implants. At present, it is difficult to determine the amount of rotation of the maxillary segments created by the expansion appliance.

A FOLLOW-UP STUDY OF TEETH REPLANTED AFTER ACCIDENTAL LOSS—K. Lenstrup, V. Skieller, Acta Odontologica Scandinavica: Vol. 17, No. 4, P. 503-509, Dec. 1959.

The authors have evaluated the long term prognosis of teeth replanted following loss in accidents. This study comprised 46 patients—8 adults and 38 children. The patients were examined at regular intervals following the replantation and the teeth were studied clinically, roentgenographically, and with electric vitalometer tests.

Of the total number of patients examined, 20 lost the replanted tooth either because of resorption, periodontitis, or orthodontic reasons. These patients were observed from several days to over five years. Of the remaining 26 patients, the replanted tooth was still present, but 22 of these patients showed root resorption upon x-ray examination. Observation for this group varied from two months to almost five years. Four patients showed no root resorption but two of these cases had no completion of the root at the time of replantation and both were replanted without root canal treatment. In one of the patients, repositioning was made immediately without removing the tooth from the oral cavity; in another case the tooth was preserved in in solution of penicillin and reinserted half an hour following the accident.

In most patients, replantation was performed after root canal therapy. The root tip was removed in the amount of one to two millimeters and the apical surface rounded off. Several cases were replanted without any root canal treatment. Fixation consisted of either an acrylic splint, or cap splint worn six to twelve weeks following the replantation.

It is interesting to note in the reported tables that the greatest number of accidental loss of teeth occurred at eight and ten years of age. The maxillary central incisor tooth was found to be affected more than the maxillary lateral incisor. Few teeth were lost in the mandible.

Conclusions arrived at by the authors are the following: Long term prospects of preserving a replanted tooth are unfavorable; there is a great variation in the time of inception of the resorption and the rate at which it proceeds; there is no relation between the time lapse from the accident to the replantation; the less mature the root, the more pronounced and progressive will be the resorption; replantation of young teeth in the earliest stages of root development gives the best results if done without root canal treatment; prospects of eliminating damage by orthodontic measures should be evaluated in each case.

M. M. ALBUM

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Case Report of Giant Cell Tumor of Mandible

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ROBERT EWBANK, D.D.S**
CHARLES HUTTON, D.D.S.†

GREAT advances in pedodontics including child patient management have been achieved. However, many young patients do not receive all that modern dentistry has to offer. Such services as the constructing of space maintainers and prosthetic appliances following extensive oral surgery should be encouraged as being vitally important for proper oral growth, development, and function.

This is a case report of a child with recurrent central giant cell tumor of the mandible, and multiple caries, whose complete oral care required the combined efforts of an oral surgeon and a pedodontist.

This five-year-old boy was referred for diagnosis and treatment of a swelling of the mandible and was admitted to Riley Hospital for Children (Indiana University Medical Center).

The history obtained from the father revealed that nine months previously a red swelling had been noticed at the lingual of the anterior mandibular teeth. The family dentist extracted the four incisor teeth, and removed a small mass of tissue, following a roentgenographic examination. The area apparently healed in about one week.

Approximately two weeks prior to his admission, the boy showed the parents the present swelling, which had been there for an undetermined period of time.

The past medical history was non-contributing.

Oral examination revealed multiple caries, generally poor hygiene, and a large mass on the anterior mandibular ridge, with swelling and expansion both labially and lingually (Fig. 1). The area measured 1 x 1 x 0.5 centimeters, was soft, inflamed, and non-tender.

The lesion on roentgenographic study was found to be radiolucent from cuspid to cuspid, exhibited anterior expansion in this area, and had displaced the developing permanent incisor teeth (Figs. 2 & 3). Roentgenographs of the remaining teeth revealed multiple deep carious lesions with periapical pathology (Figs. 4 & 5).

All laboratory studies and physical findings were considered within normal limits, except for multiple hard masses

FIGURE 1

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FIGURE 2

which were palpable along the left side of the abdomen. These were movable, non-tender, and believed to be feces.

The tentative diagnosis of giant cell tumor was made, and the patient scheduled for surgery the following day.

Medication consisted of: Penicillin, 300,000 units stat, B.i.d. and soap suds enema h.s. Pre-anesthetic drugs were:

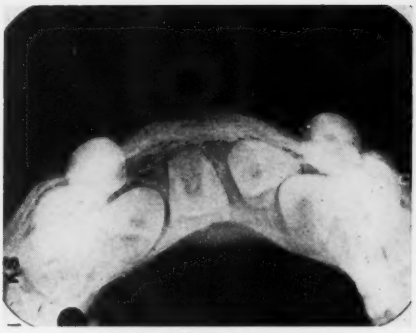

FIGURE 3

Demerol 30 mg. and Atropine 0.2 mg. one hour before surgery.

In the operating room anesthesia induction was with open drop Vinethene, followed by naso-endotracheal intubation, and nitrous-oxide, oxygen, and Fluothane (R) maintenance. He was prepared and draped in the usual manner, and representative piece of tissue removed for frozen section examination. While waiting for the tissue examination, all primary molars, the maxillary central incisors, and left mandibular cuspid teeth were extracted. Frozen section diagnosis was central giant cell tumor.

An incision was made along the mandibular alveolar crest from first molar to first molar, and mucous membranes reflected, exposing the extent of the lesion

FIGURE 4

FIGURE 5

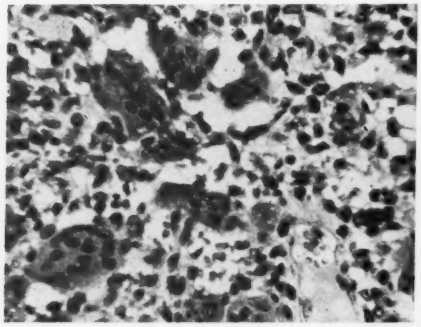

FIGURE 6

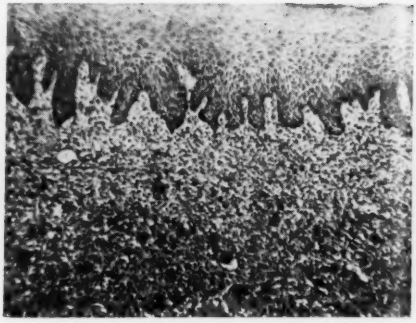

FIGURE 7

which was enucleated with considerable hemorrhage being encountered. The permanent tooth buds of the right lateral and both central incisors were found to be involved, and were removed with their follicles. The involved bone was excised, the area smoothed, hemorrhage controlled, and closures made with .000 silk sutures.

While in the operating room, the patient received 300 cubic centimeters whole blood, and 300 cubic centimeters five per cent dextrose in water. He withstood the procedure well, and was sent to the recovery room responding and in satisfactory condition.

Permanent hematoxilin and eosin tissue section confirmed the diagnosis (Figs. 6, 7, 8).

The immediate post-operative course was uneventful, and discharge from the hospital was on the second post-operative day. Sutures were removed on the fifth day, and a schedule of follow-up examinations was made.

Four months later there was no evidence of recurrence (Fig. 9), new bone was filling in, and he was referred back to the pedodontic department for further treatment.

Acrylic partial dentures were to be constructed as space maintainers, as well as to aid the patent's masticatory function, and to improve esthetics.

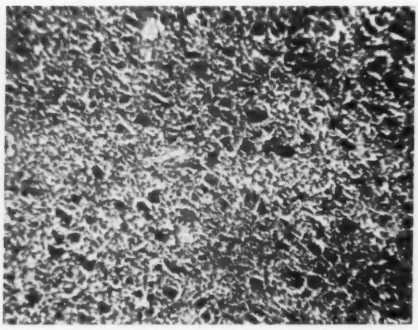

FIGURE 8

FIGURE 9

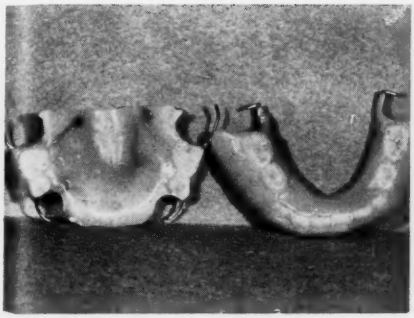

FIGURE 10

FIGURE 11

Alginate impressions were taken of the mandibular and maxillary arches, and the casts were mounted on an articular, using a wax bite.

Stainless steel wires were adapted as clasps on the maxillary molars and cuspids, using .030 wire for the molars, and 0.28 wire for the cuspids. Occlusal rests were constructed for the mandibular molars using .030 wire. The partial dentures were then waxed up, using posterior and anterior acrylic teeth, and were packed with heat-cured acrylic (Fig. 10).

The dentures were placed in the mouth, and the occlusion was properly adjusted (Fig. 11). The patient was extremely pleased with the dentures, and accepted them very readily. The patient was re-examined in one week and was found to be doing very satisfactorily.

He is continuing to be followed by the pedodontic clinic for periodic adjustments of the dentures as new teeth erupt, and for post-operative roentgenographs as observation for possible recurrence of the original central giant cell lesion.

SUMMARY

Presented is a case report of a giant cell tumor of the mandible in a five-year-old, complicated by multiple carious teeth. Treatment required the loss of all but four primary teeth, as well as three unerupted permanent teeth.

The surgical procedure was considered to be only a part of the total oral treatment plan, and prosthetic appliances were constructed to act as space maintainers, as well as functional and esthetic dentures. This patient, as most children do, accepted the appliances with great enthusiasm, and wears them proudly.

A long-term follow-up program is necessary for the purpose of making adjustments and changes, to keep pace with growth and development.

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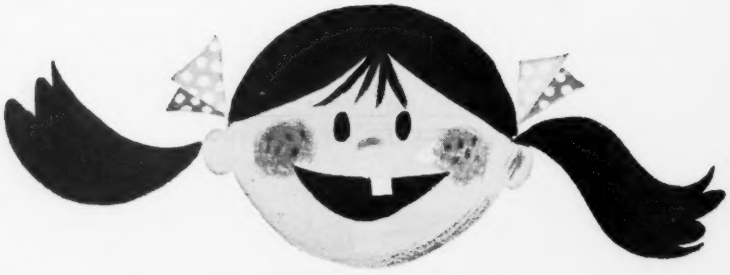

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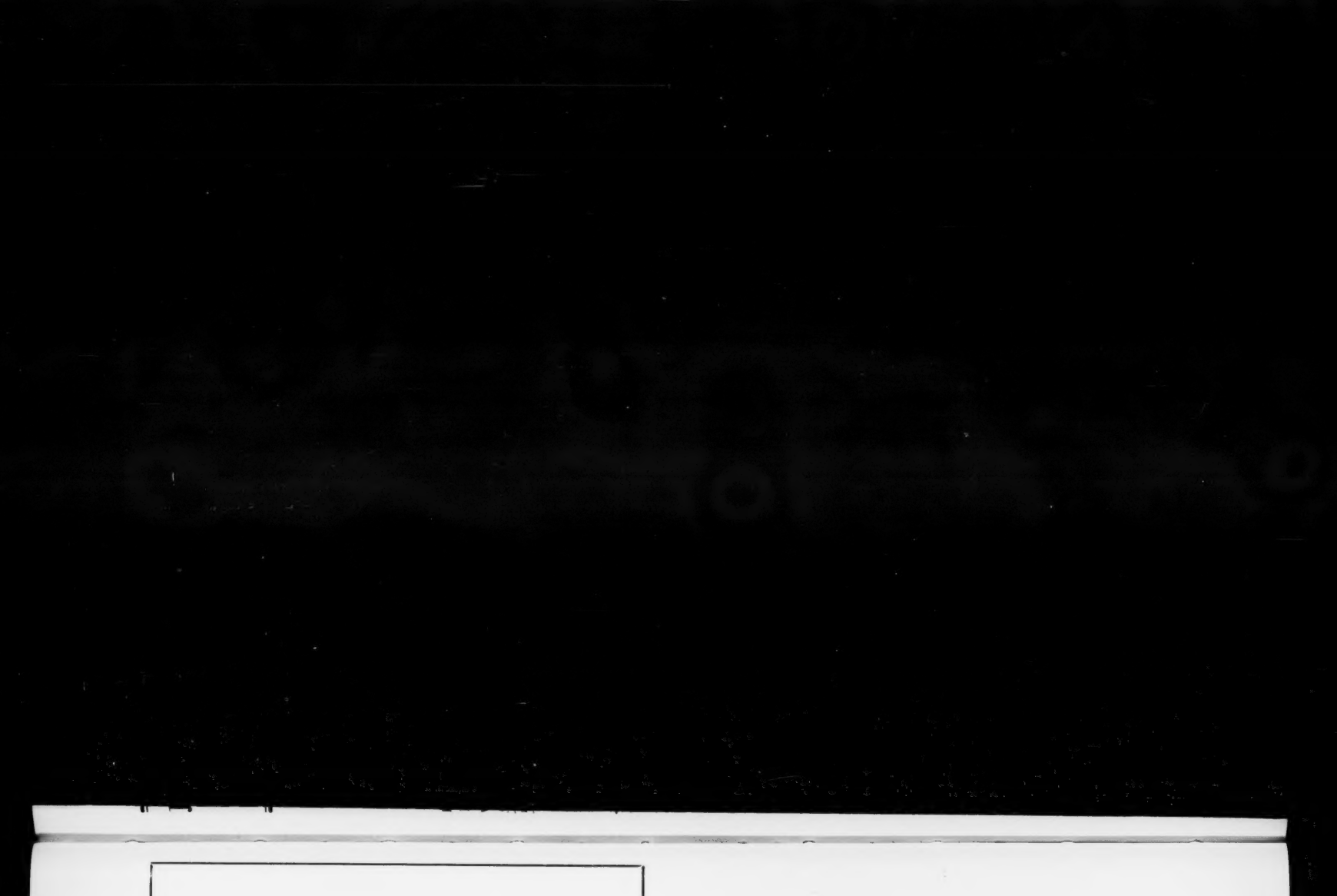
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